2014 Furbearer Program Annual Report

MISSOURI DEPARTMENT OF CONSERVATION

RESOURCE SCIENCE DIVISION

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INTRODUCTION

Missouri's wild fur market has been monitored annually since 1940, with some information dating back to 1934. Over time, we've seen tremendous fluctuations in the harvest of Missouri's primary furbearing animals as both market and social trends change. The Missouri Department of Conservation (MDC) monitors the fur market using mandatory fur dealer transaction records, mandatory pelt registration of bobcats (since 1980) and river otters (since 1996), and information gathered at fur auctions. The information in this report is based on harvest from trappers and hunters.

The number of Fur Dealer Permits issued by MDC peaked at 1,192 during the 1945-46 trapping and hunting season. In 2013, MDC issued 58 Resident and 7 Non-Resident Fur Dealer Permits. The number of Resident Trapping Permits issued peaked at 13,248 in 1980-81 (permits were first required in 1953), and reached a low of 2,050 in 2000. During the 2013-14 trapping season, MDC issued 10,681 Resident and 323 Non-Resident Trapping Permits (Table 1).

Total pelts harvested reached 834,935 in 1940-41 (over 70% were opossum and skunk pelts), and reached the second highest peak in 1979 at 634,338 when average raccoon pelt values were estimated at $27.50. The economic value of harvested fur also peaked in 1979-80 at over $9 million. Pelt values declined dramatically during the late 1980s and through the mid-1990s; as a result the number of participants fell to all-time lows. Market trends for the 2014 season suggest that pelt values for many furbearers are losing some strength as territorial disputes in Russia and tariffs in China add uncertainly for those working in the fur industry.

In addition to harvest information, wildlife population trends are monitored using observations collected by bow hunters (archer's indices) and MDC staff (sign station surveys). Archer's indices are based on annual wildlife observation reports sent in by cooperating bow hunters. Sign station surveys are conducted each September by Conservation Department staff in 25 counties. A more detailed account of sign station surveys and archer's indices is described in Section 2.

Also contained in Section 2 are updates and progress summaries for various furbearer-related research projects, monitoring efforts, and items of interest. Section 2 is for informational purposes and should be considered preliminary reports. For more information on any of these reports please contact Jeff Beringer at jeff.beringer@mdc.mo.gov.

SECTION 1:

Missouri Furbearer Status 2013-2014

FUR HARVEST COMPARISONS

To buy and sell fur in Missouri (fur dealer) individuals must be issued a commercial permit from the MDC. The permit requirements include maintaining and submitting records of all fur transactions. Data collected from fur dealers gives MDC an estimate of furbearer harvest. In addition, harvest numbers for bobcats and otters are gathered from mandatory pelt registration required by the Convention on International Trade of Endangered Species (CITES). A combination of favorable weather and strong fur prices in the previous season resulted in high participation by hunters and trappers this past fall. MDC issued over 10,000 trapping permits, which is a 25-year high. The coyote harvest was the highest in the last 25 years. Participation by furbearer hunters has been increasing. Recent survey data suggest over 13,000 hunters pursued raccoons and over 25,000 hunters pursued coyotes this past year. Forecasts for 2014 are uncertain, as a result permit sales and harvest will like diminish relative to 2013 levels.

Table 1. Furbearer harvest and pelt prices in Missouri over the last three years.

Species	2013-14		2012-13		2011-12	
	Number of pelts sold or registered*	**Pelt Prices from MTA Auctions**	**Number of pelts sold or registered***	**Pelt Prices from MTA Auctions**	**Number of pelts sold or registered***	**Pelt Prices from MTA Auctions**
Raccoon	134,715	$13.04	138,865	$20.79	158,356	$10.00
Opossum	11,529	$1.63	7,733	$1.25	12,185	$1.23
Muskrat	11,445	$9.94	15,699	$11.79	23,031	$9.49
Coyote	7,631	$18.12	7,025	$22.26	4,494	$14.93
Beaver	5,133	$14.86	9,302	$21.72	7,572	$13.47
Mink	715	(m)$14.81 (f)$12.50	1,254	(m)$26.72 (f)$18.67	1,499	(m)$18.15 (f)$10.01
Red Fox	1,772	$36.24	1,401	$39.13	1,191	$30.08
Gray Fox	1,034	$24.01	1,066	$34.72	757	$20.26
Striped Skunk	402	$2.50	442	$3.25	451	$1.80
Badger	65	$17.50	80	$0.38	62	$15.63
Bobcat*	4,310	$120.13	5,059	$115.50	4,199	$77.66
River Otter*	2,584	$60.57	4,201	$85.53	4,233	$87.80
Trapping permits issued	10,681		9,192		7,549	

* Pelts issued (except bobcat and otter where harvest is based on CITES registration) is based on reports received from 43 Fur Buyer Permittees

MISSOURI FUR AUCTION PRICES

The Missouri Trappers Association (MTA) held two fur auctions this year in Montgomery City MO. Prices are averaged from all fur sold, including green, finished and damaged (Table 2). Average pelt prices were lower by nearly 30% this year for most species (Table 3). Most notably raccoon prices dropped over 35% from last year. Otter prices were off nearly 30%. Bobcats remained strong with average auction prices over $120, an all- time high in Missouri.

Table 2. Range of furbearer pelt prices in Missouri during the 2013-14 trapping season.

	2014 Auction Summary				
Species	**Total Number of Pelts Sold**	**08-Feb**	**22-Feb**	**Average Prices for 2014**	**Change in Price from 2013**
Raccoon	5,554	$12.31	$13.61	$13.04	-37.3%
Opossum	283	$1.82	$1.41	$1.63	+30.4%
Muskrat	678	$9.08	$11.04	$9.94	-15.7%
Coyote	207	$17.11	$18.90	$18.12	-18.6%
Beaver	290	$15.03	$14.77	$14.86	-31.6%
Mink – Male	37	$13.17	$18.68	$14.81	-38.9%
Mink – Female	2	N/A	$12.50	$14.05	-33.0%
Red Fox	108	$36.56	$35.86	$12.50	-7.4%
Gray Fox	36	$20.20	$25.48	$24.01	-30.8%
Striped Skunk	6	$1.75	$2.88	$2.50	-23.1%
Badger	2	$17.50	N/A	$17.50	+4505.3%
Bobcat	159	$105.85	$125.26	$120.13	+4.0%
Otter	208	$61.79	$60.35	$60.57	-29.2%

Table 3. Comparison of average furbearer auction prices over the last five trapping seasons.

Species	Average Price Per Season					5-year average
	2013-14	2012-13	2011-12	2010-11	2009-10	
Raccoon	$13.04	$20.79	$10.00	$10.98	$12.20	$13.40
Opossum	$1.63	$1.25	$1.23	$1.70	$2.22	$1.61
Muskrat	$9.94	$11.79	$9.49	$6.21	$6.91	$8.87
Coyote	$18.12	$22.26	$14.93	$11.04	$10.95	$15.46
Beaver	$14.86	$21.72	$13.47	$9.94	$13.75	$14.75
Mink (male)	$14.81	$24.05	$18.15	$14.18	$10.67	$16.37
Red Fox	$36.24	$39.13	$30.08	$16.78	$14.82	$27.41
Gray Fox	$24.01	$34.72	$20.26	$18.02	$15.08	$22.42
Str. Skunk	$2.50	$3.25	$1.80	$1.87	$2.75	$2.43
Badger	$17.50	$0.38	$15.63	N/A	$3.50	$7.40
Bobcat	$120.13	$115.5	$77.66	$45.21	$36.30	$78.96
Otter	$60.57	$85.53	$87.80	$46.95	$37.84	$63.74

RACCOON POPULATION AND HARVEST TRENDS

Raccoon harvest, including trapping, for the 2013-14 season was 134,715, down 2.99% from the 2012-13 season and down 14.93% from the 2011-12 season (Figure 1). Many trappers reported lower numbers of raccoons and much of the harvest was comprised of adult males. The archer observation data corroborated this observation as raccoon indices were down 25%. Drought conditions throughout Missouri may have reduced raccoon survival or caused range shifts away from dry creeks and wetlands.

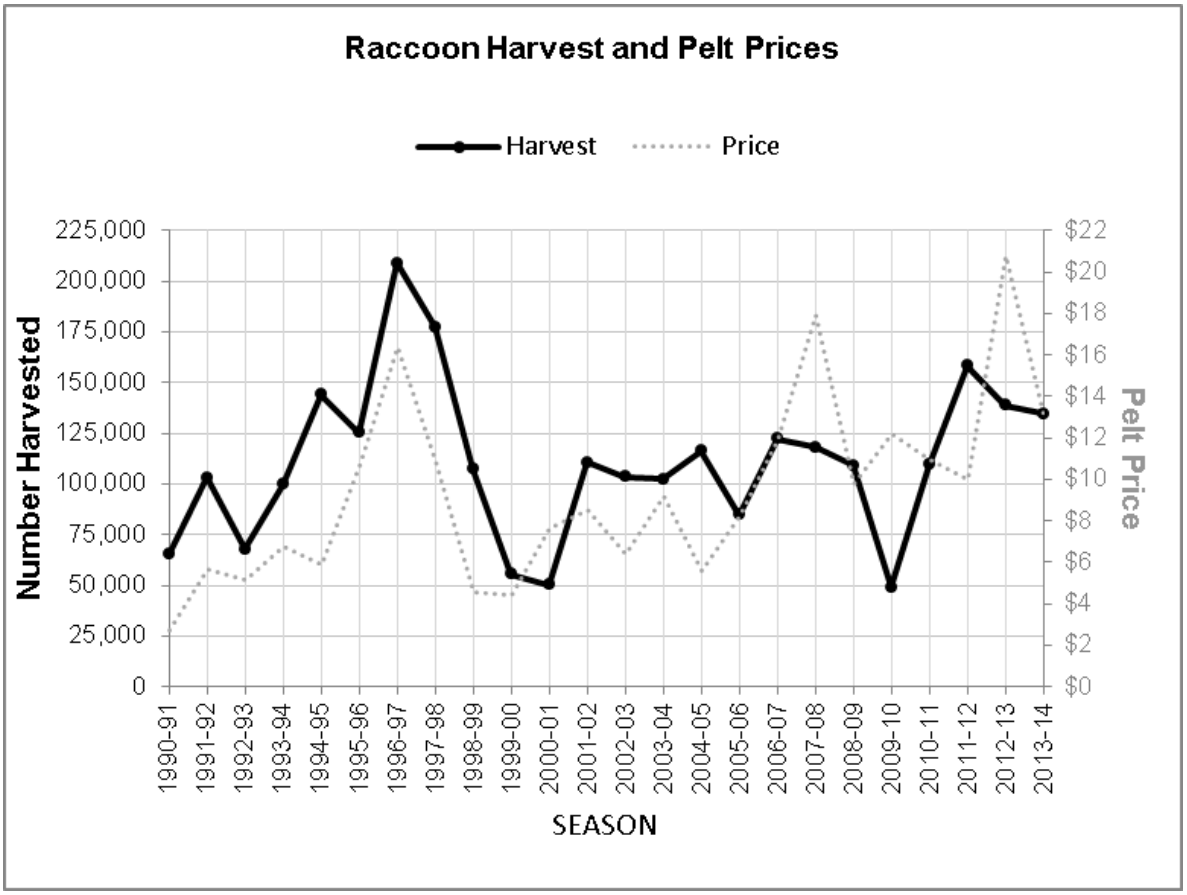

Figure 1. Comparison of raccoon harvest and pelt prices over the last 24 years.

Raccoon indices declined for the second year in row. Based on observations from bowhunters, the number of raccoons sighted per 1000 hours of hunting decreased about 25% to 33.3% in 2013, down from 45.8% in 2012 (Figure 2). The presence of raccoon tracks at furbearer sign stations also fell, although slightly, to an index of 143.12 in 2013, after reaching an all-time high index of 186.88 in 2012. The observed declines could be a result of increased harvest pressures and/or a habitat shift from the extreme heat and drought experienced during the summer months of 2013. Public reports of daytime observations of sick raccoons (usually distemper) were in the normal range.

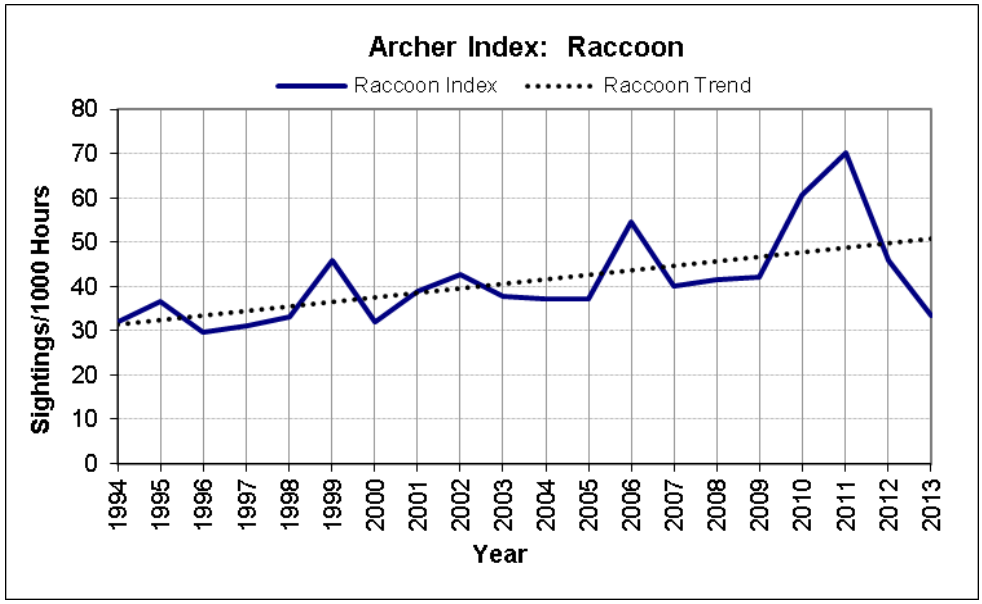

Figure 2. Raccoon population trends based on the MDC bowhunter observation survey.

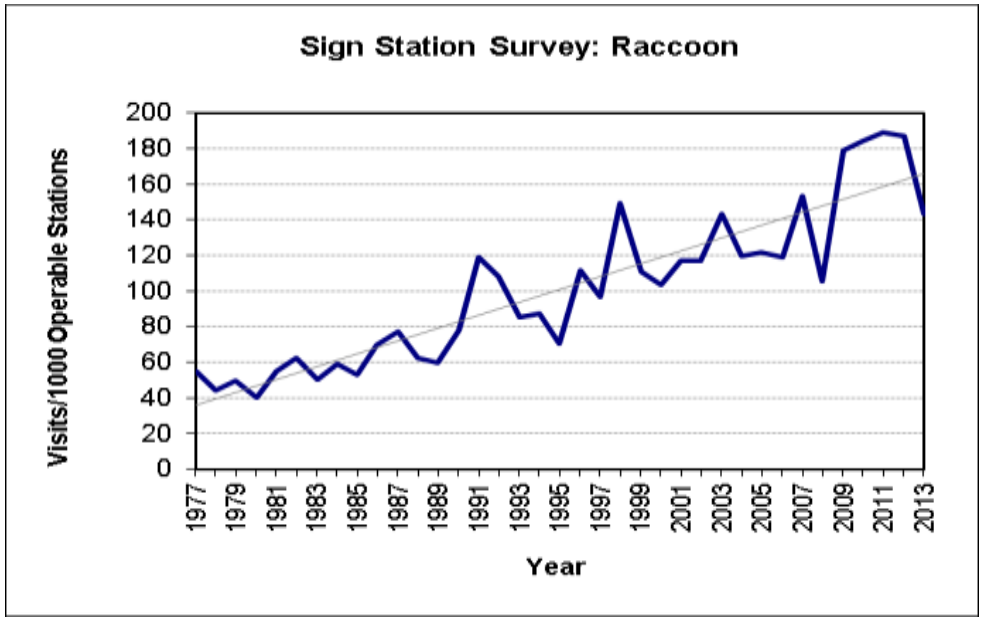

Figure 3. Raccoon population trends based on sign station surveys.

COYOTE POPULATION AND HARVEST TRENDS

Coyote harvest during the 2013-14 furbearer season (7,631) was up 8.63% from the 2012-13 season (Figure 4) and marked a 25-year high. Predator hunting continues to increase in popularity and survey data suggest over 25,000 people hunted coyotes in 2013-14. Weather likely affected coyote trapping as we experienced warm dry weather for much of the season. Although coyote pelt prices averaged only $18.12, many trappers still enjoy the challenge of catching coyotes. The use of cable restraints has increased coyote harvest for the fur and live markets. Trend data for coyotes suggest populations are stable but higher than those observed during the mid-1970s (Figures 5 and 6). Mange in both coyotes and red fox is reported each year but major outbreaks have not been confirmed for 2013.

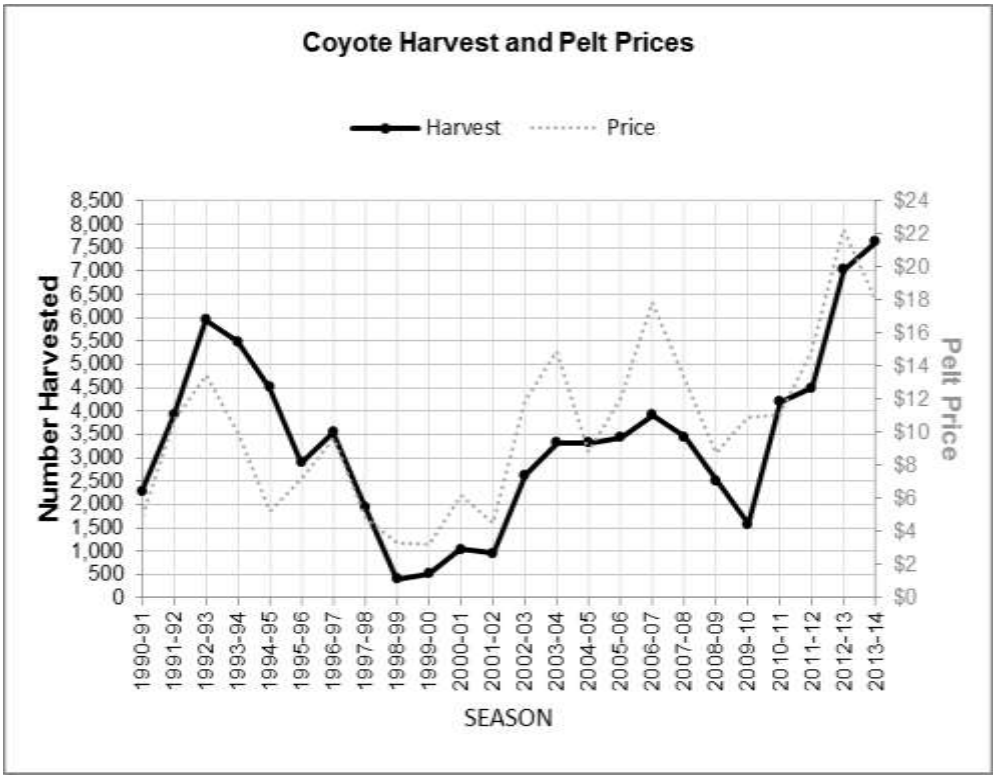

Figure 4. Comparison of coyote harvest and pelt prices over the last 24 years.

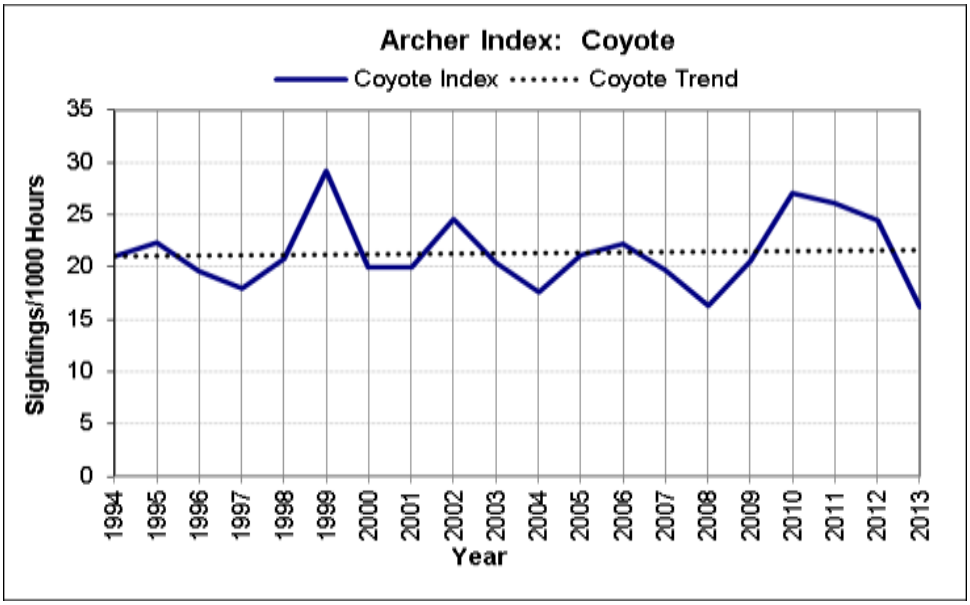

Figure 5. Coyote population trends based on the MDC bowhunter observation survey.

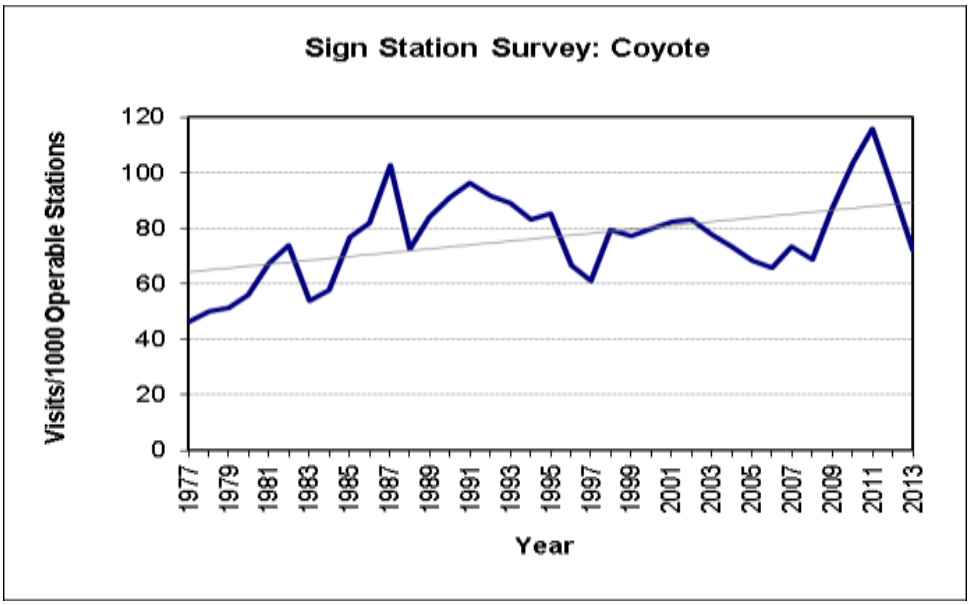

Figure 6. Coyote population trends based on sign station surveys.

FOX POPULATION AND HARVEST TRENDS

During the 2013-14 season, red fox harvest (1,772) increased 26.48% and gray fox harvest (1,034) decreased by 3.00% when compared with last year's harvest (Figures 7 and 8). Fox harvest is typically a by-product of bobcat or coyote trapper effort. Bobcat fur prices were high in 2013 and as a result, land trappers were active and fox harvest increased. From a long term perspective, both archer observations and sign station surveys suggest declines in both red and gray fox populations (Figures 9 and 10), although, gray fox were stable based on the archer's index. Long term fox population declines may be the result of interspecies competition with coyotes and bobcats. Another possible reason for the gray fox decline could be the increasing population of raccoons and their associated distemper virus; gray fox seem especially vulnerable to distemper virus.

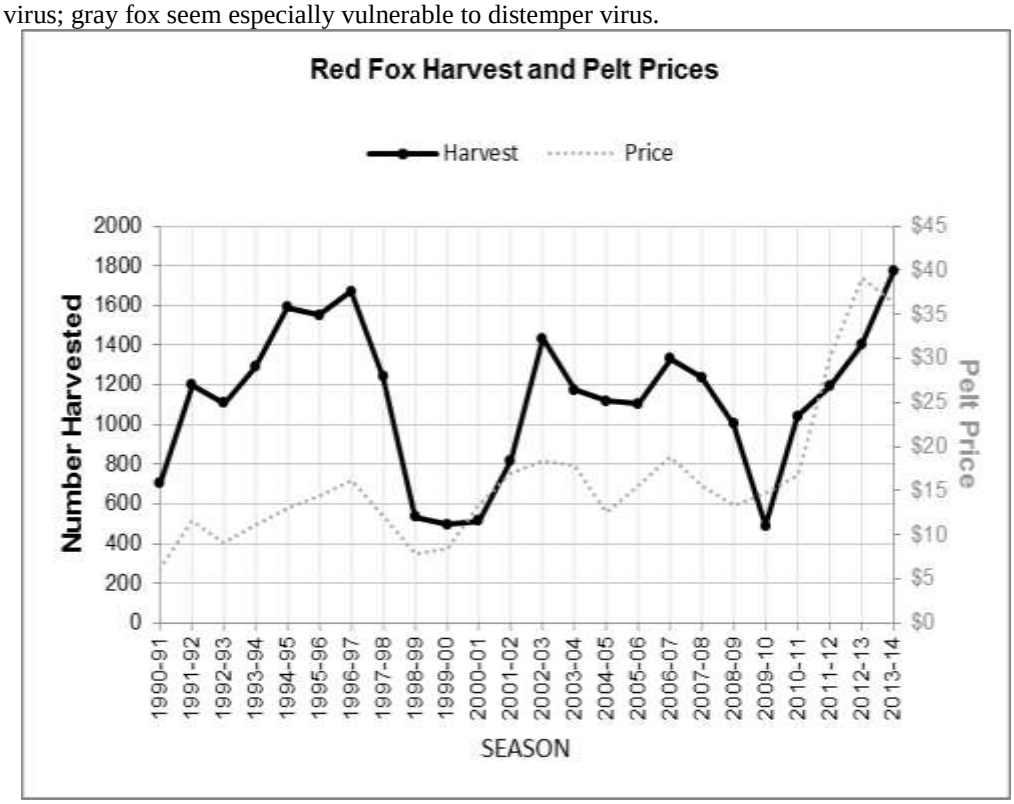

Figure 7. Comparison of red fox harvest and pelt prices over the last 24 years.

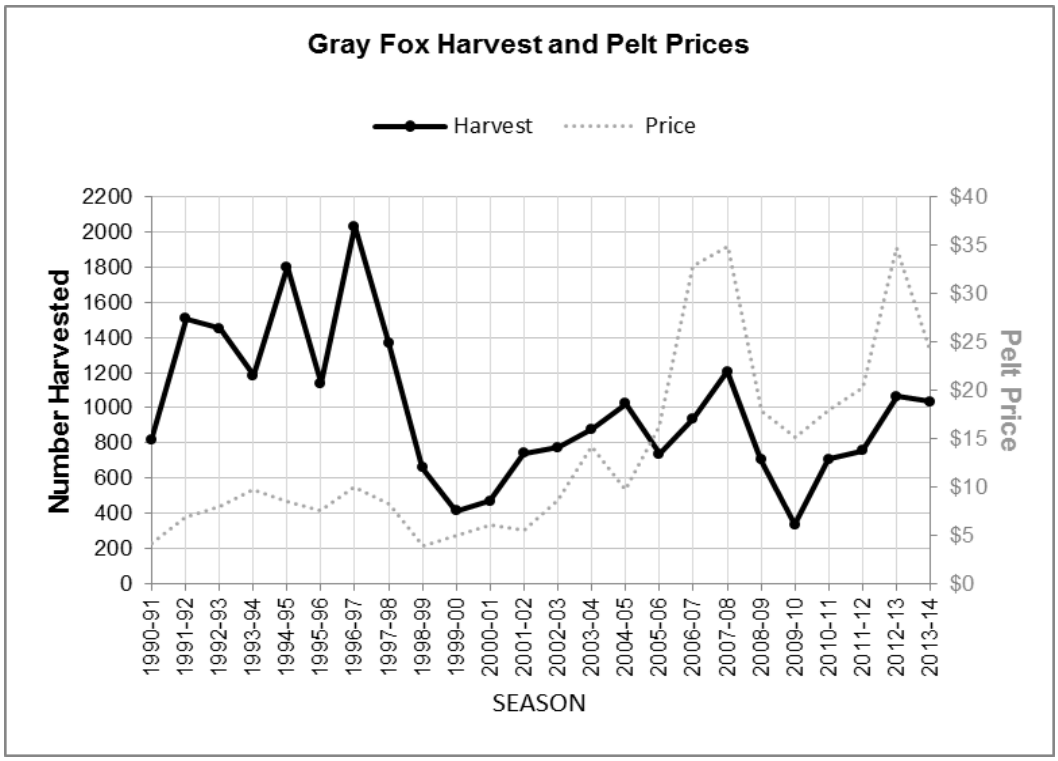

Figure 8. Comparison of gray fox harvest and pelt prices over the last 24 years.

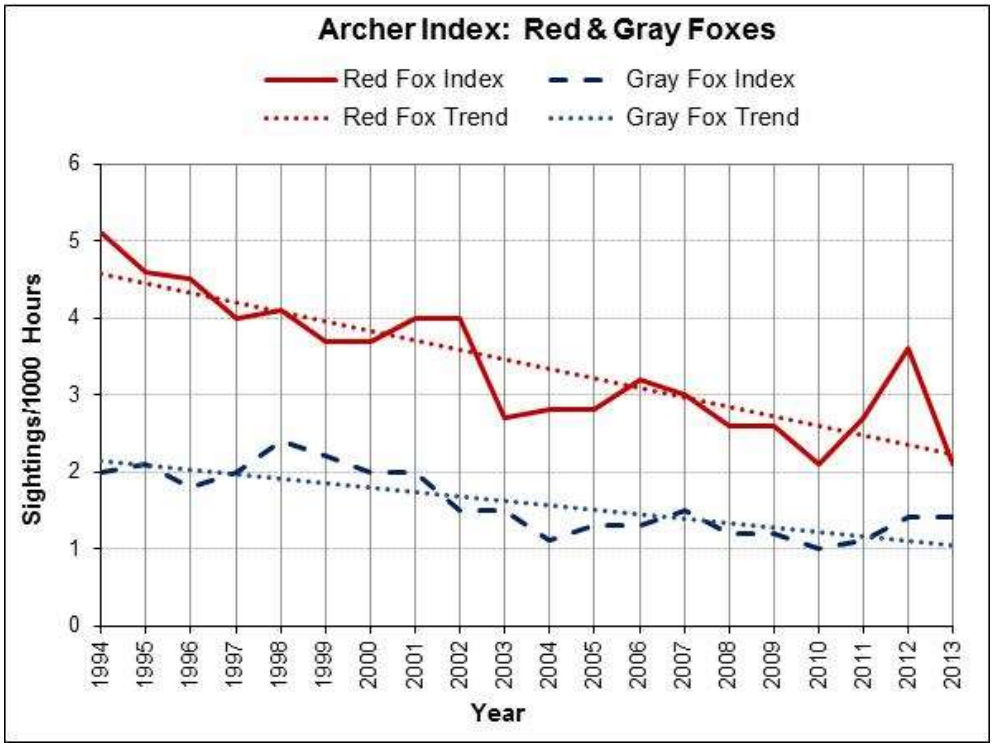

Figure 9. Fox population trends based on MDC bowhunter observation survey.

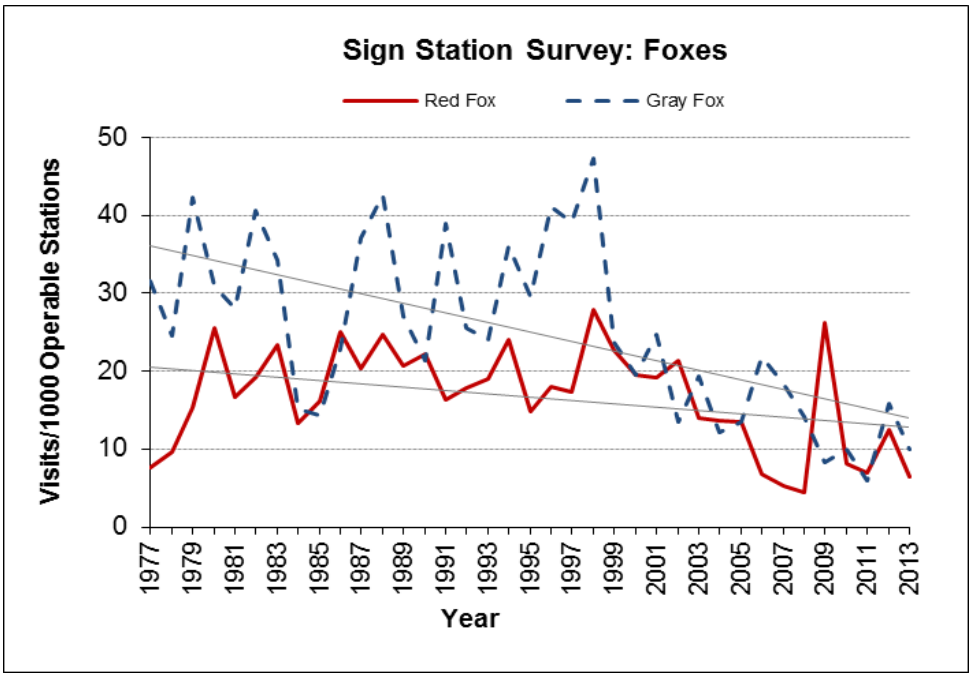

Figure 10. Fox population trends based on sign station surveys

BOBCAT POPULATION AND HARVEST TRENDS

Trappers and hunters are required to check and attach a seal to bobcat carcasses or green pelts at MDC offices or with Conservation Agents. The data collected are used to monitor bobcat harvest in Missouri and to comply with CITES regulations.

During 2013-14, 4,310 bobcats were harvested, a decrease of 14.81% from 2012-13, but was 2.64% above the 2011-12 season (Figure 11). Pelt prices during the 2013-14 furbearer season, reached all-time highs at local auctions averaging $120.13. Bobcats have continued to expand across north Missouri and have now established in all suitable habitats. During 2013-14, Missouri had a significant increase in trappers and, although the mild weather may have reduced movements, the dry conditions were more favorable for land trapping.

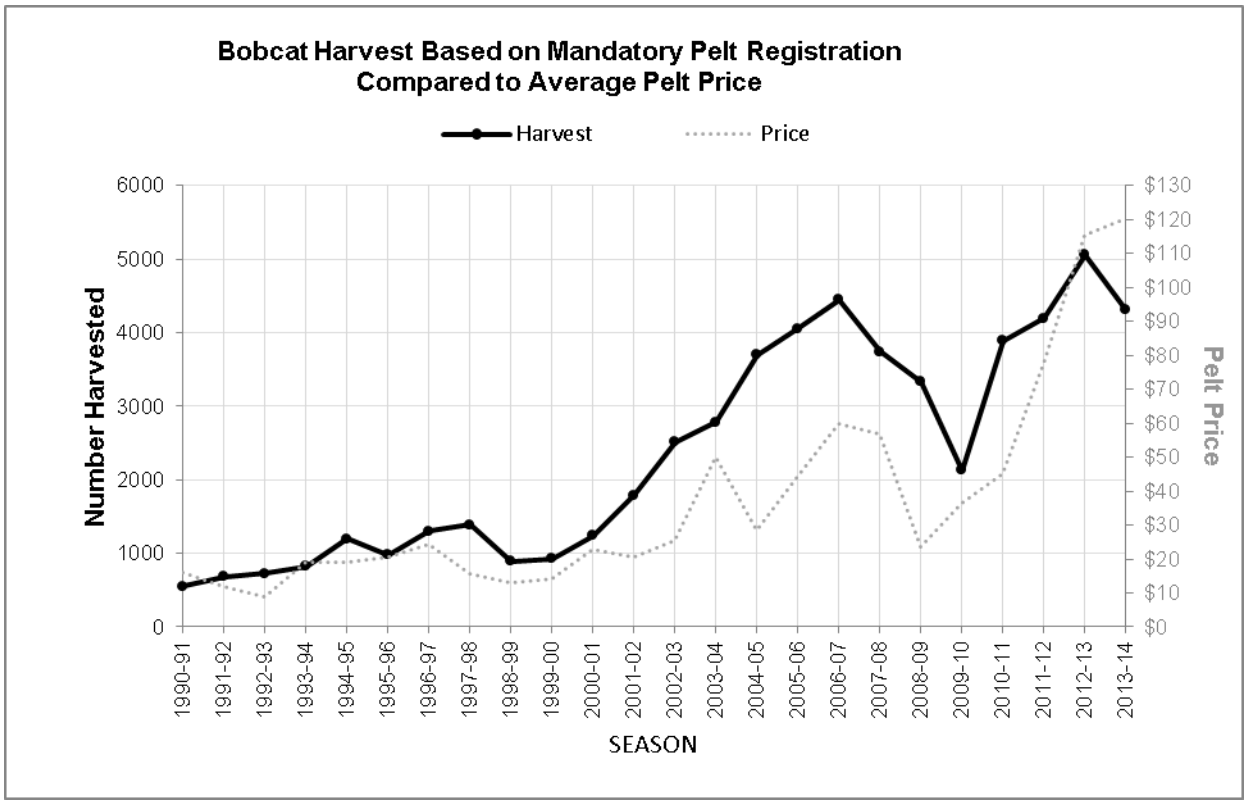

Figure 11. Bobcat harvest trends over the last 24 years compared to average pelt prices.

The number of bobcat pelts purchased by fur dealers (2,833) was significantly less than the number of bobcats checked by trappers as required by CITES (4,310). Instead of selling to fur buyers, trappers can make more money by selling carcasses to taxidermists or selling mounted bobcats on the internet. The significant drop in pelt sales to fur dealers is likely a reflection of this trend.

Both sign station and Archer Index data suggest bobcat populations may have dipped some over the last couple years – the overall trend appears to be stable to slightly increasing (Figures 12 and 13). Regional harvest was not markedly different for most areas except northern regions where significant declines were apparent. Limited habitat during winter likely increases vulnerability of bobcats in these regions. (Table 4, Figure 15). Bobcat harvest distribution suggests high harvest occurs early in the season, mostly from firearms deer hunters, and trapping harvest is later (Table 5). Pelts are generally prime after December.

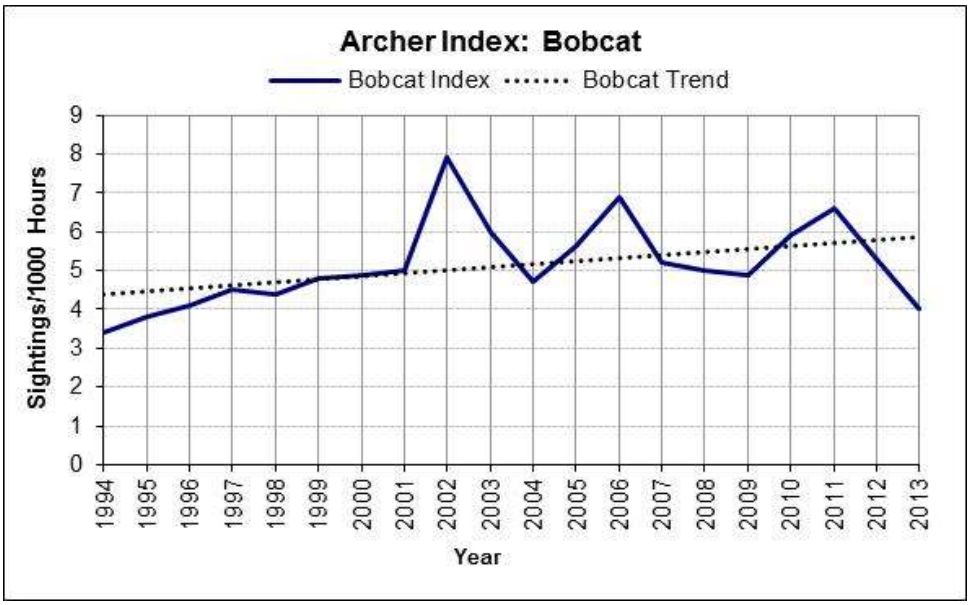

Figure 12. Bobcat population trends based on the MDC bowhunter observation survey.

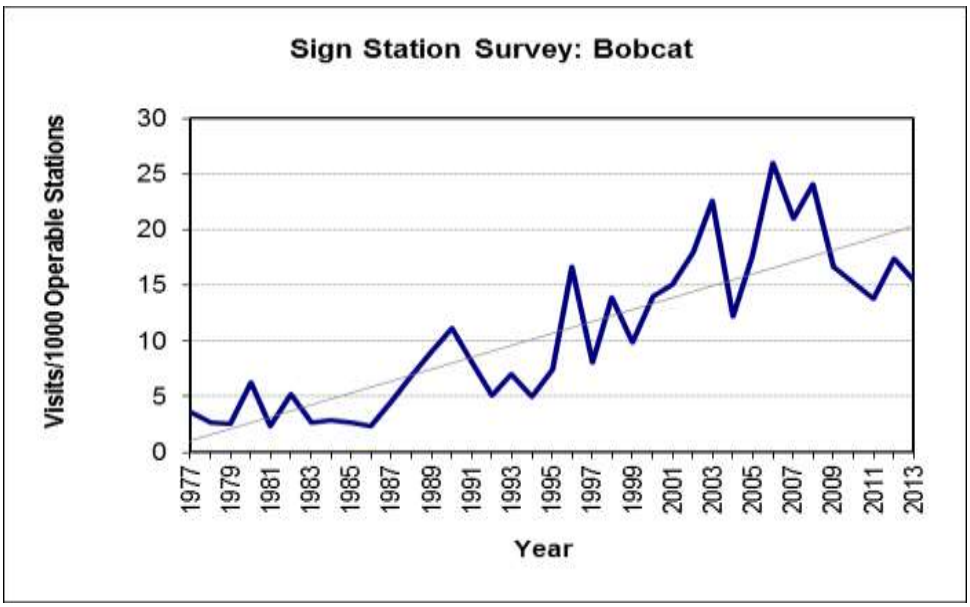

Figure 13. Bobcat population trends based on sign station surveys.

Table 4. Bobcat harvest (based on mandatory pelt registration) and pelt prices from 2004 – 2014, in Missouri, by zoological region.

	Bobcats Harvested per Season									
Zoological Region	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Northwest Prairie	410	470	493	358	341	150	342	391	421	260
Northern Riverbreaks	552	604	636	373	404	192	412	465	473	374
Northeast Riverbreaks	446	558	678	521	492	379	608	617	644	544
Western Prairie	624	616	763	572	446	235	542	694	807	629
Western Ozark Border	364	473	431	377	312	223	453	450	560	444
Ozark Plateau	881	852	918	984	868	550	962	1012	1486	1459
North and East Ozark Border	291	289	372	316	307	243	369	395	439	429
Mississippi Lowlands	133	208	158	159	157	154	185	165	208	159
Unknown	0	1	4	46	6	2	0	10	21	12
TOTAL	3,701	4,061	4,453	3,706	3,333	2,128	3,888	4,199	5,059	4,310
Bobcat Pelt Prices	$28.50	$44.53	$59.78	$56.93	$23.68	$36.30	$45.21	$77.66	$115.50	$120.13

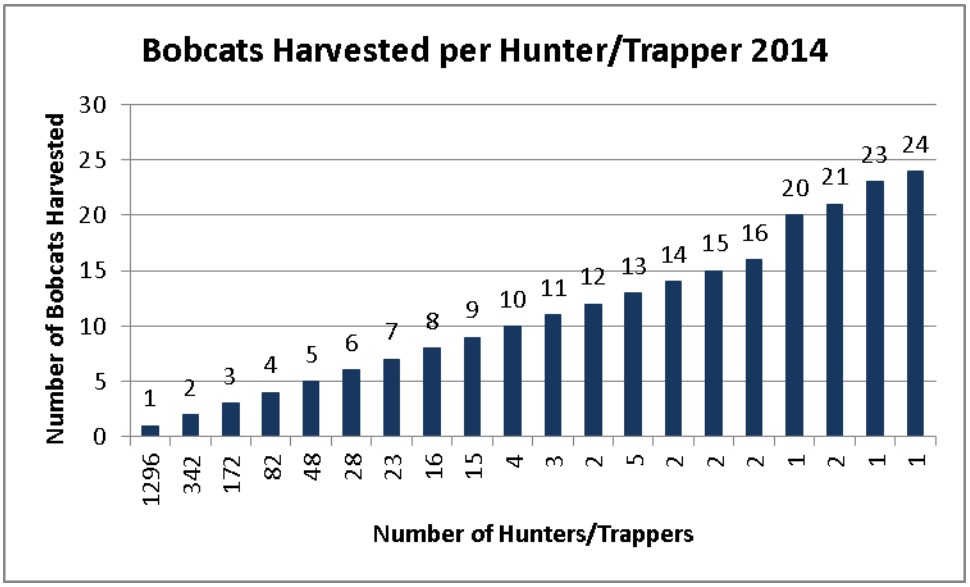

Figure 14. Number of bobcats harvested per individual hunter/trappers.

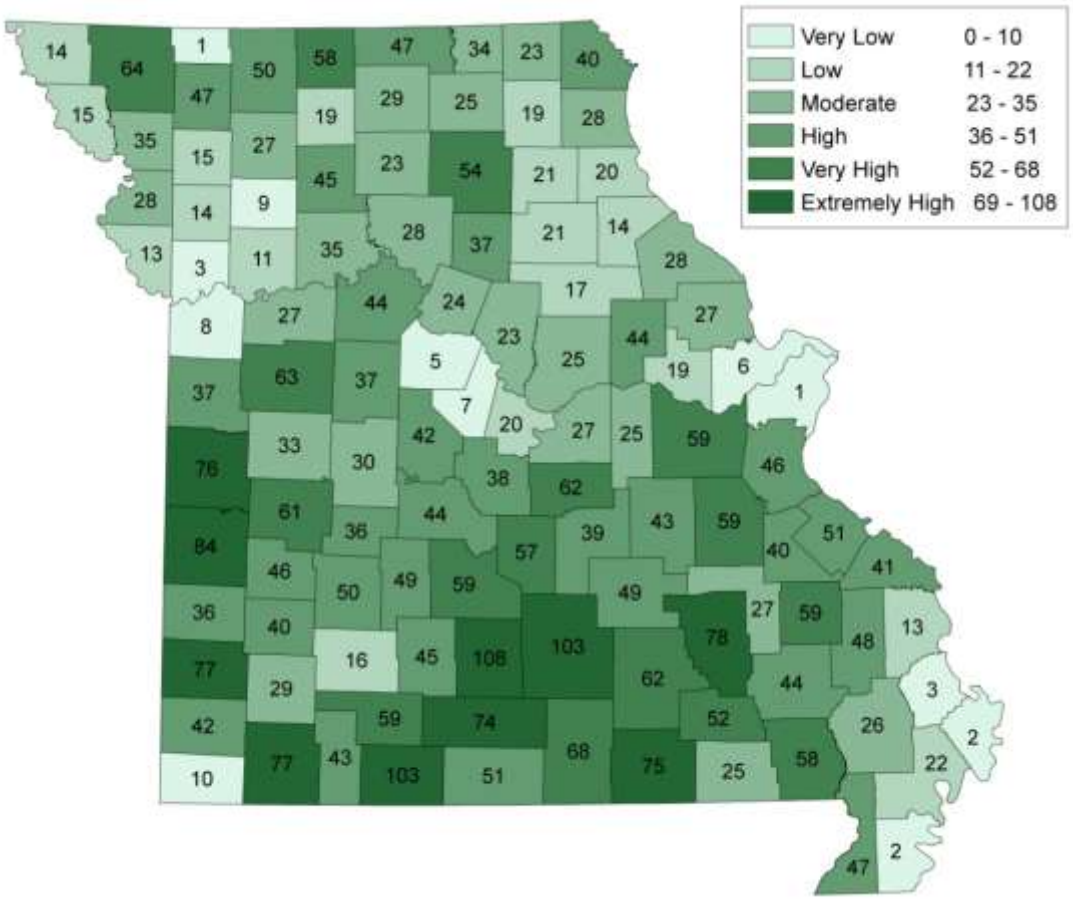

Figure 15. Bobcat harvest by county during the 2013-2014 furbearer season.

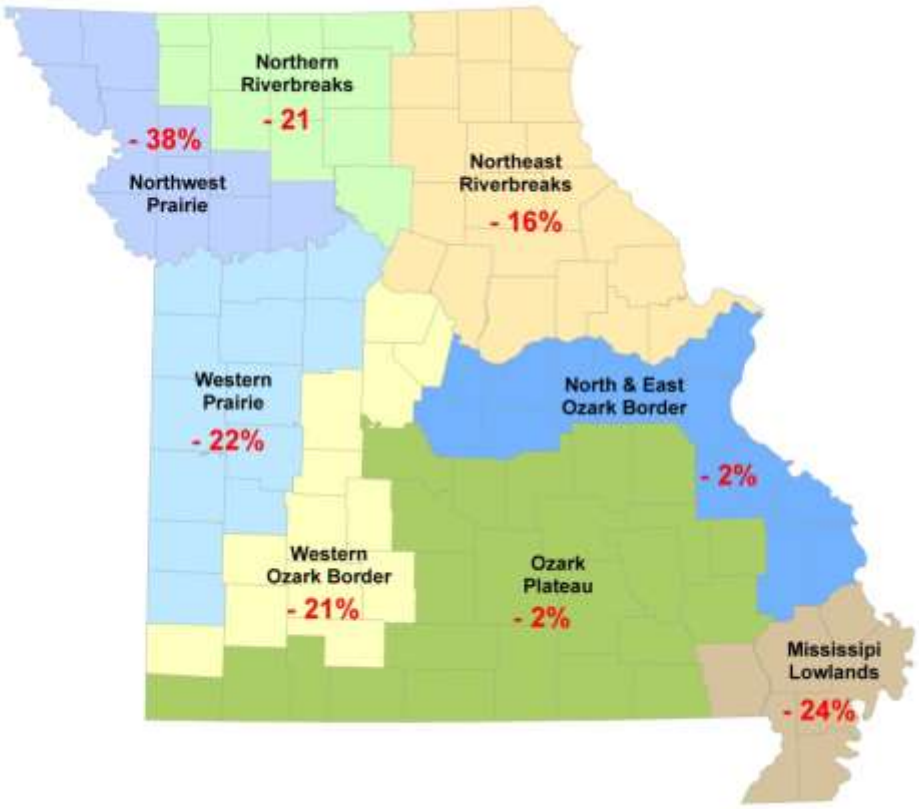

Figure 16. Comparison of bobcat harvest by Zoogeographic region between the 2012-13 and 2013-14 furbearer seasons.

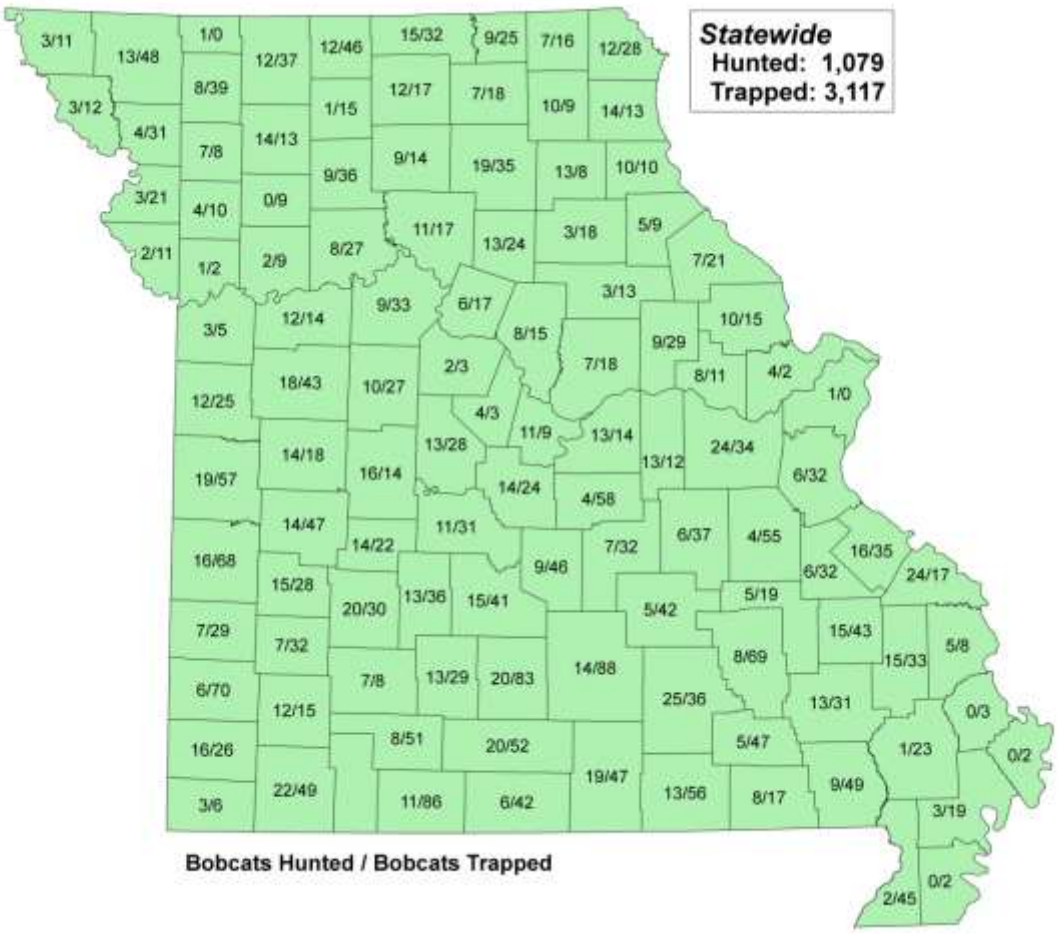

Figure 17. Comparison of hunted vs. trapped bobcats per county in the 2013-2014 season.

OTTER POPULATION AND HARVEST TRENDS

Trappers are required to check and attach a seal to river otter carcasses or green hides at MDC offices or with Conservation Agents. The data collected are used to monitor statewide and regional otter harvest in Missouri and to comply with CITES regulations.

The 2013-14 furbearer season resulted in a harvest of 2,584 animals. This is down 38.40% from the season last year, and down 38.86% from the record high 2011-2012 season. Otter pelt prices declined 29.2% from last year. High harvest during the previous two furbearer seasons and lower pelt prices are likely the reasons for decreased harvest in the 2013-14 season (Figure 18). Harvest date for otter and bobcat are available as a result of CITES tagging. Both species have a relatively long harvest season (Table 5).

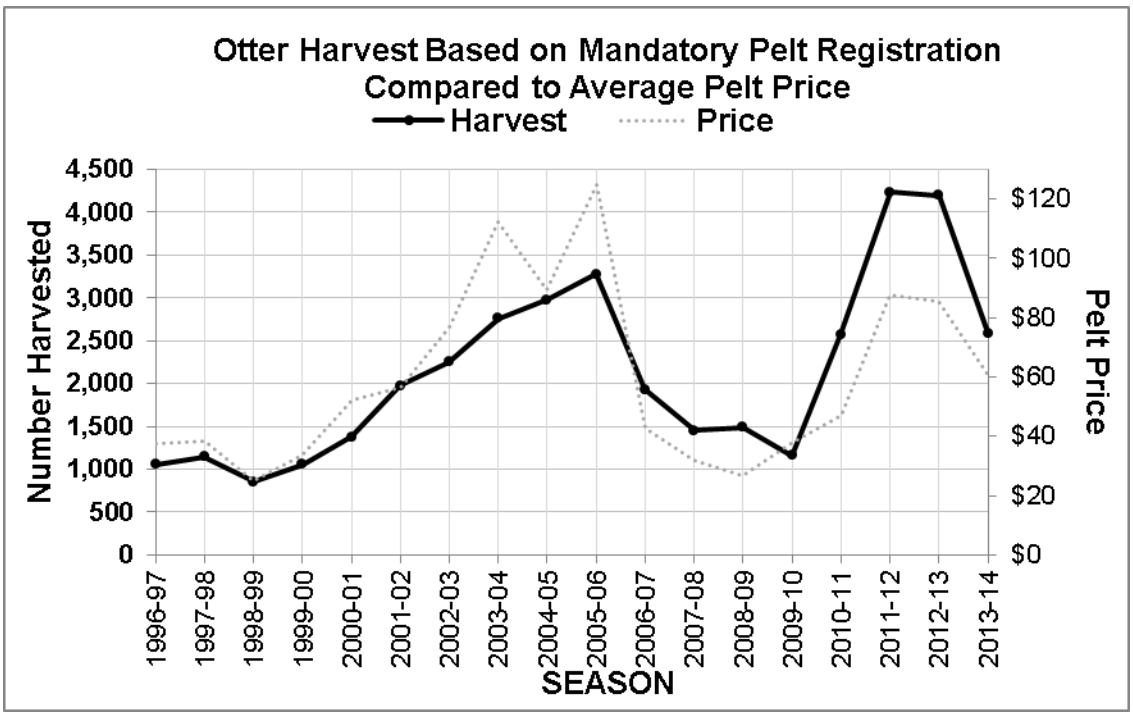

Figure 18. Otter harvest and pelt prices from 1990 – 2014.

Table 5. Bobcat and otter harvest during each week of the 2013-14 season.

Week of Season	Dates	Number of Bobcats Harvested	Number of Otters Harvested
—	Before Nov. 15	16	5
1	Nov.15 – 16	111	45
2	Nov. 17 – 23	355	236
3	Nov. 24 – Nov. 30	384	216
4	Dec. 1 – 7	407	300
5	Dec. 8 – 14	316	196
6	Dec. 15 – 21	424	290
7	Dec. 22 – 28	437	222
8	Dec. 29 – Jan 4	415	213
9	Jan. 5 –11	304	164
10	Jan. 12 – 18	420	172
11	Jan. 19 – 25	368	161
12	Jan. 26 – Feb 1	259	104
13	Feb 2 – 8	—season closed—	70
14	Feb. 9 – 15	—season closed—	62
—	Feb 16 – 20	—season closed—	82
—	Unknown date	94	60
	TOTAL	4,310	2,584

Although most otter harvest occurs during December and January (Table 5), a longer season does facilitate targeted harvests. From a county basis, otter harvest was highest in Chariton, Linn and Texas counties with harvests of 118, 68 and 66, respectively (Figure 19). Other high harvest counties were in the south-east and north-central regions of Missouri.

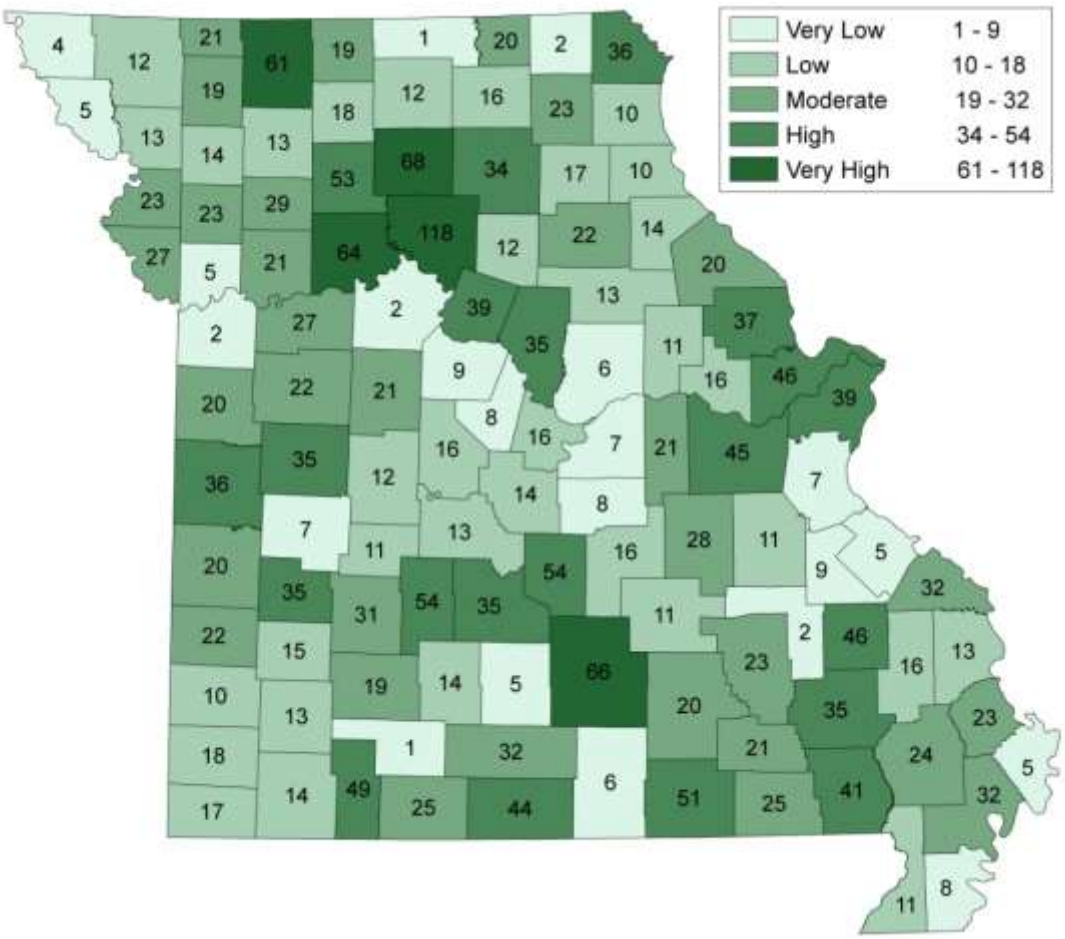

Figure 19. The number of otters harvested by county during the 2013-14 season.

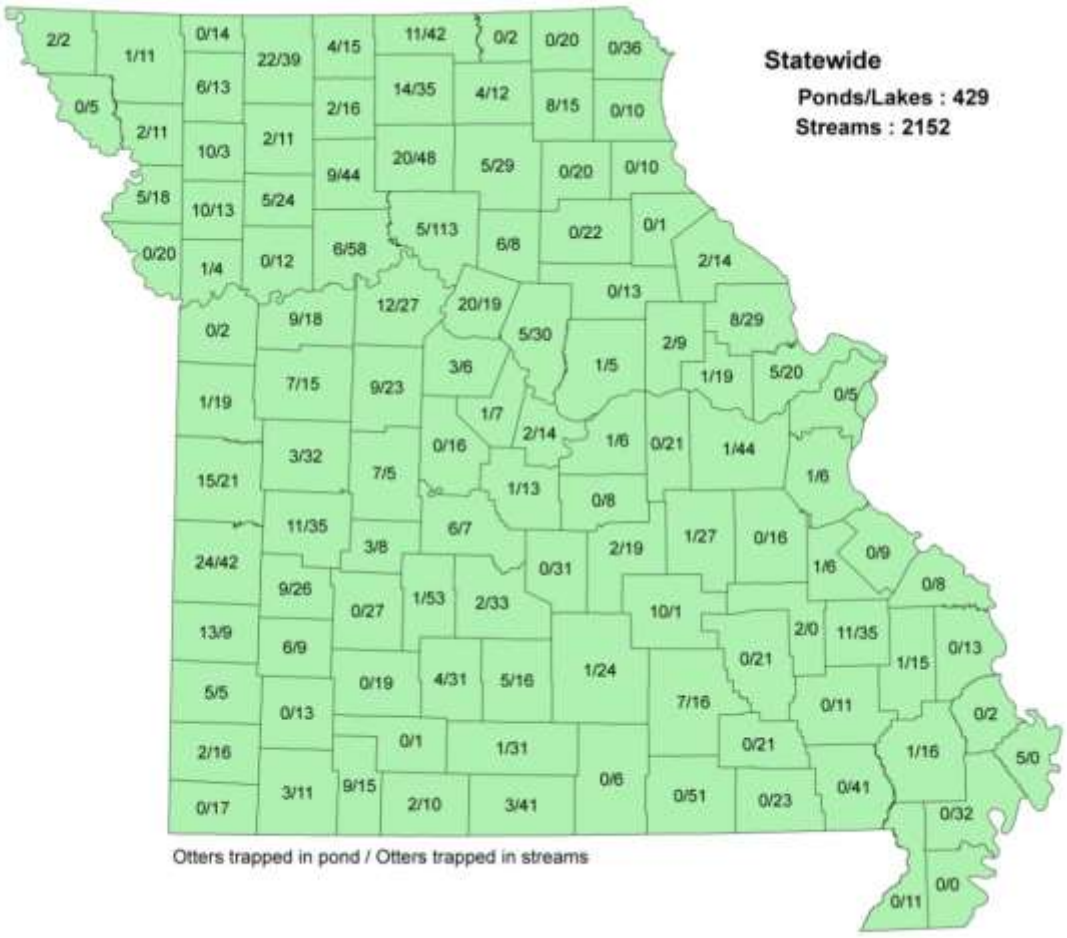

Figure 20. Comparison of otters trapped in ponds vs. streams.

Otter harvest during the 2013-14 season was highest in the Missouri River, Grand River and Gasconade River watersheds (Figure 21, Table 6). Over 22% (580) of total otters harvested were in these three watersheds. Other watersheds with high harvest included the Chariton River, Osage River and N. Fork White River.

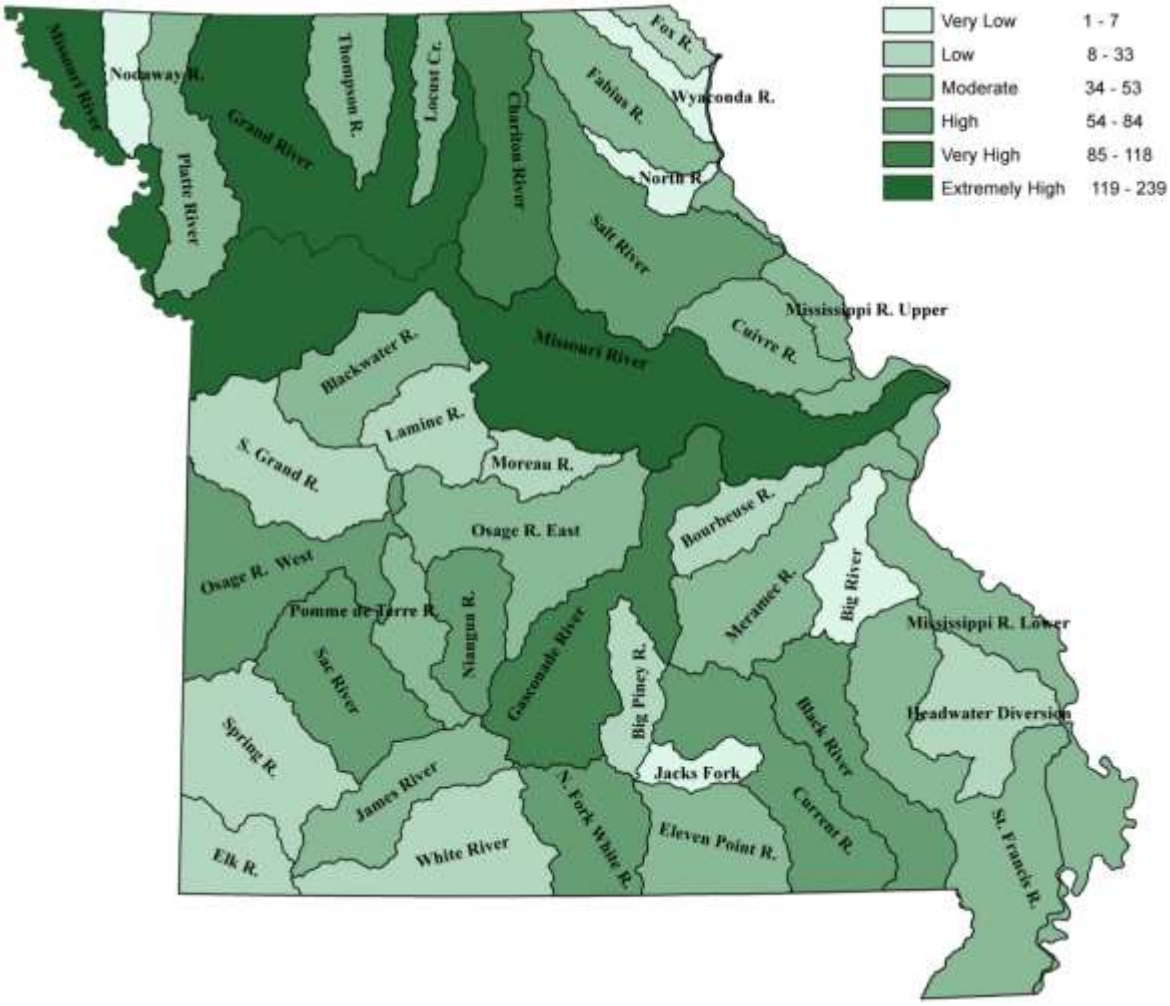

Figure 21. Otter harvest distribution among watersheds during the 2013-14 trapping season.

Table 6. Otter harvest distribution among watersheds during the 2013-14 trapping season.

Watershed	Number Harvested	Percent of Harvest
Big Piney River	19	0.73%
Big River	6	0.23%
Black River	64	2.47%
Blackwater River	49	1.89%
Bourbeuse River	28	1.08%
Chariton River	105	4.06%
Cuivre River	37	1.43%
Current River	60	2.32%
Eleven Point River	53	2.05%
Elk River	31	1.20%
Fabius River	45	1.74%
Fox River	24	0.93%
Gasconade River	118	4.56%
Grand River	223	8.62%
Headwater Diversion	33	1.28%
Jacks Fork River	2	0.08%
James River	43	1.66%
Lamine River	27	1.04%
Locust Creek	48	1.86%
Meramec River	49	1.89%
Mississippi R. (lower)	40	1.55%

Watershed	Number Harvested	Percent of Harvest
Mississippi R. (upper)	46	1.78%
Missouri River	239	9.24%
Moreau River	21	0.81%
N. Fork White River	76	2.94%
Niangua River	57	2.20%
Nodaway River	5	0.19%
North River	7	0.27%
Osage River East	45	1.74%
Osage River West	84	3.25%
Platte River	43	1.66%
Pomme de Terre River	36	1.39%
S. Grand River	30	1.16%
Sac River	67	2.59%
Salt River	62	2.40%
Spring River	30	1.16%
St. Francis River	51	1.97%
Thompson River	46	1.78%
White River	17	0.66%
Wyaconda River	5	0.19%
Unknown	516	19.95%
TOTAL HARVEST	2587	100%

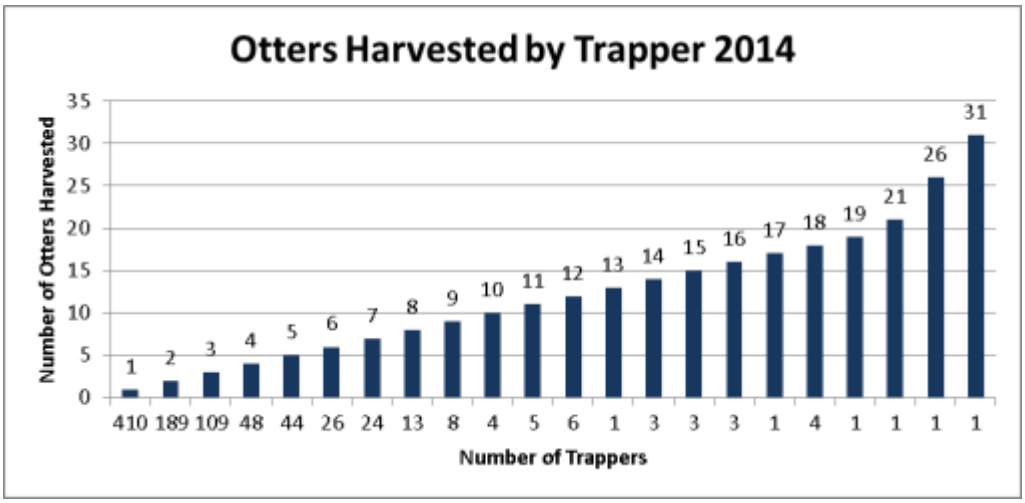

Figure 22. Number of otters harvested by individual trappers.

BEAVER AND MUSKRAT HARVEST TRENDS

Harvest rates for beaver and muskrat continue to fluctuate in somewhat predictable ranges. Since 1990 muskrat harvests have varied from about 5,000 – 20,000 and beaver from 2,000 – 10,000. Historically, muskrat numbers have fluctuated widely however habitat degradation has limited populations. Beavers are a longer- lived species and less vulnerable to predators, harvest rates are more likely related to pelt values. Last year trappers harvested 11,445 muskrats and 5,133 beaver.

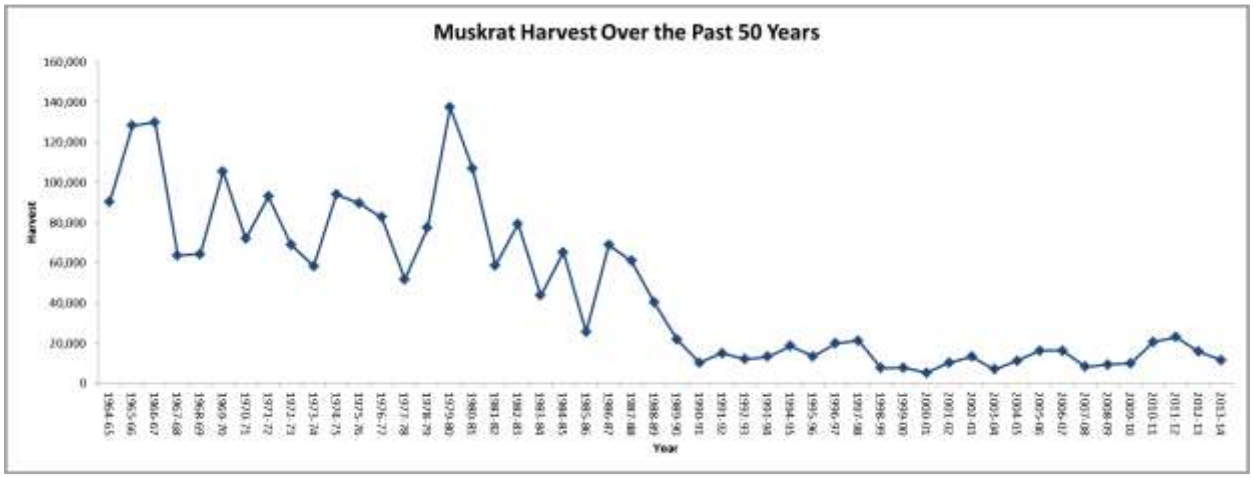

Figure 23. Number of muskrats harvested in the last 50 years.

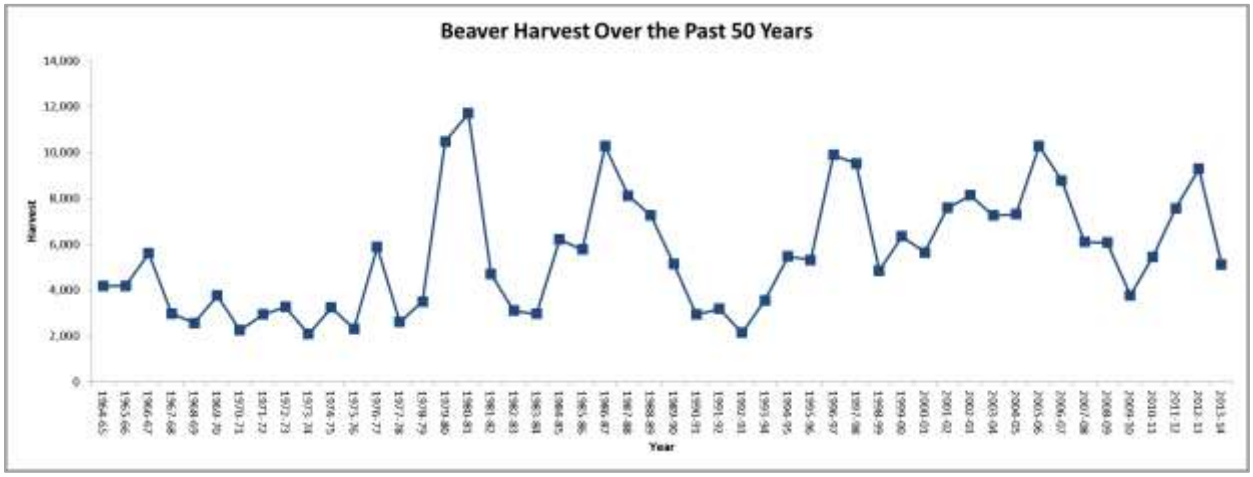

Figure 24. Number of beavers harvested in the last 50 years.

SECTION 2:
Project Updates and Summaries

Cable Restraints in Missouri

After studying reports about the safe and efficient use of cable restraints to capture coyotes and foxes, the Missouri Trappers Association (MTA) and the Missouri Department of Conservation (MDC) entered into a cooperative agreement to provide resident trappers in Missouri with training to learn the best methods for using cable restraints on land for appropriate furbearers. When used properly, cable restraints hold captured animals without mortalities and with few significant injuries.

Since cable restraints hold animals alive and without significant injuries, they are much different from traditional land snares. Because of this distinction, cable restraints can be safely used in areas where other traps pose problems for pets and other animals.

Using cable restraints is a highly regulated activity as are all trapping methods. Anyone who traps must follow strict rules established and enforced by the Missouri Department of Conservation. Restrictions on species that may be harvested, harvest seasons, trap types, and areas open to trapping are some examples of the guidelines and regulations that are regularly reviewed and enforced. Trappers may only use cable restraints after completing a certified cable restraint training course. Check the MDC website for full regulations on the use of cable restraints in Missouri. There have been over 4,854 trappers certified to use cable restraints since becoming an allowable method in 2004 (Figure 25).

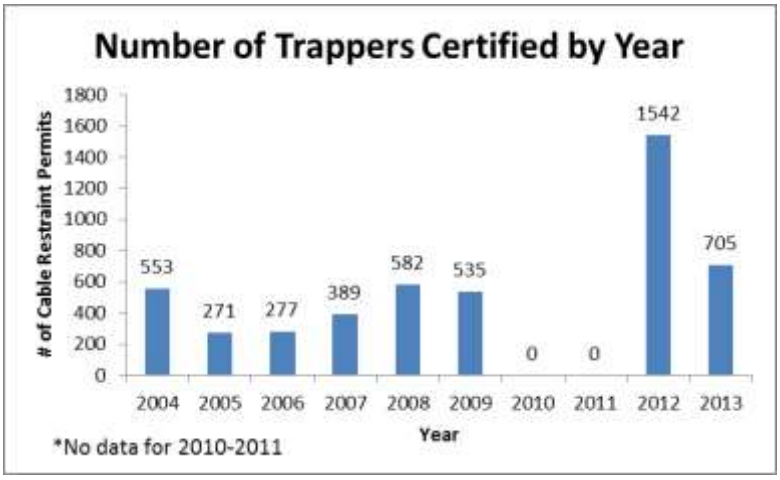

Figure 25. Number of trappers certified by year

Research Leads To Legalization of Restraints

The use of cable restraints in Missouri is based on data collected during one of the most ambitious research projects in the history of the conservation movement – the development of Best Management Practices for Trapping in the United States (BMPs). These studies were designed following the science-based field testing protocols used and perfected by the furbearer resources technical work group of the International Association of Fish and Wildlife Agencies.

In 2001 and 2002, cable restraints were field tested by experienced local trappers during legal trapping seasons in Wisconsin and Missouri. Specimens taken in Wisconsin by cable restraints were sent to wildlife veterinary pathologists from the University of Wyoming, who used international trap testing guidelines to examine the animals for trap-related injuries. The performance of cable restraints was outstanding. Due to the concerns for the safety of hunting dogs and free-roaming pets, the MDC formed an advisory committee (including dog owners) to discuss the use of cable restraints in Missouri. In the end, the committee unanimously recommended the approval of this tool for use in Missouri.

FURBEARER SIGN STATION SURVEY

SUMMARY OF 2013 FURBEARER SIGN STATION SURVEY

Background

The furbearer sign station survey occurs annually each September. The survey dates back to 1977 and gathers furbearer population trend information across the state. There are currently twenty-five routes, each in a different county. Each route is broken into five segments with 10 sign stations each, for a total of 50 sign stations per route. Sign stations are 36-inch diameter circles of sifted soil, set up every 0.3 miles along shoulders of gravel roads. In the middle of each station is a scent disc infused with a fatty acid scent attractant. Stations are set up in one day and checked the next day for presence of animal tracks. Observers note whether or not stations are operable when checking the stations. If a station has been destroyed by a road grader or other vehicle, the station is deemed inoperable and not included in index calculations. If a station is operable, it is included in the calculation of indices regardless of the presence of tracks. Observers identify any tracks within the station but do not count the number of animals of any species visiting a station.

Results

In 2013, 23 of 25 routes (Figure 26) were completed with a total of 1097 operable stations out of a possible 1150. A list of operable stations per Zoological region is shown in Table 7. Inoperable stations were due to tire tracks and road graders.

Table 7. Summary of operable and inoperable sign stations in 2013 by Zoological region.

Zooregion	Number of routes completed	Number of operable stations	Number of inoperable stations
Northwest Prairie	2	99	1
Northern Riverbreaks	3	144	6
Northeast Riverbreaks	4	191	9
Western Prairie	2	85	15
Western Ozark Border	3	144	6
Ozark Plateau	5	242	8
North & East Ozark Border	3	147	3
Mississippi Lowlands	1	45	5
TOTAL	23	1097	53

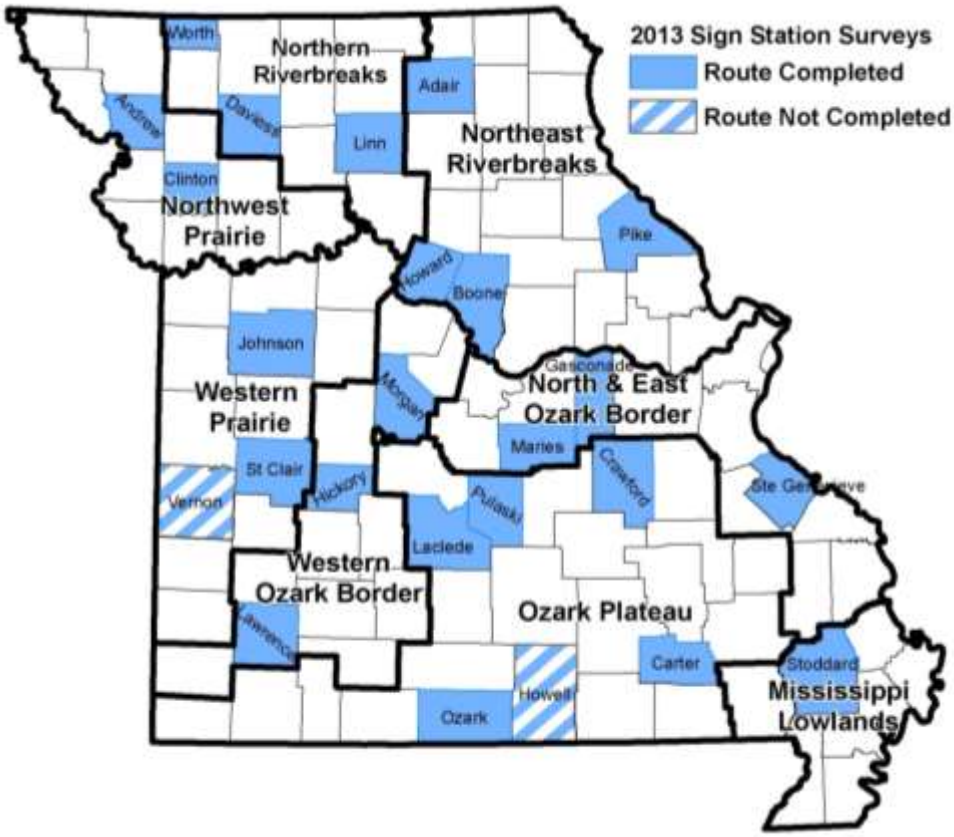

Figure 26. Map of Missouri counties with sign station routes within their respective Zoological region.

The most common furbearer species to visit sign stations include raccoon, opossum and deer (Figure 27). Less common visitors include fox, mink and weasel. Birds, such as turkeys and crows, make up the majority of the non-mammal species that visit each site.

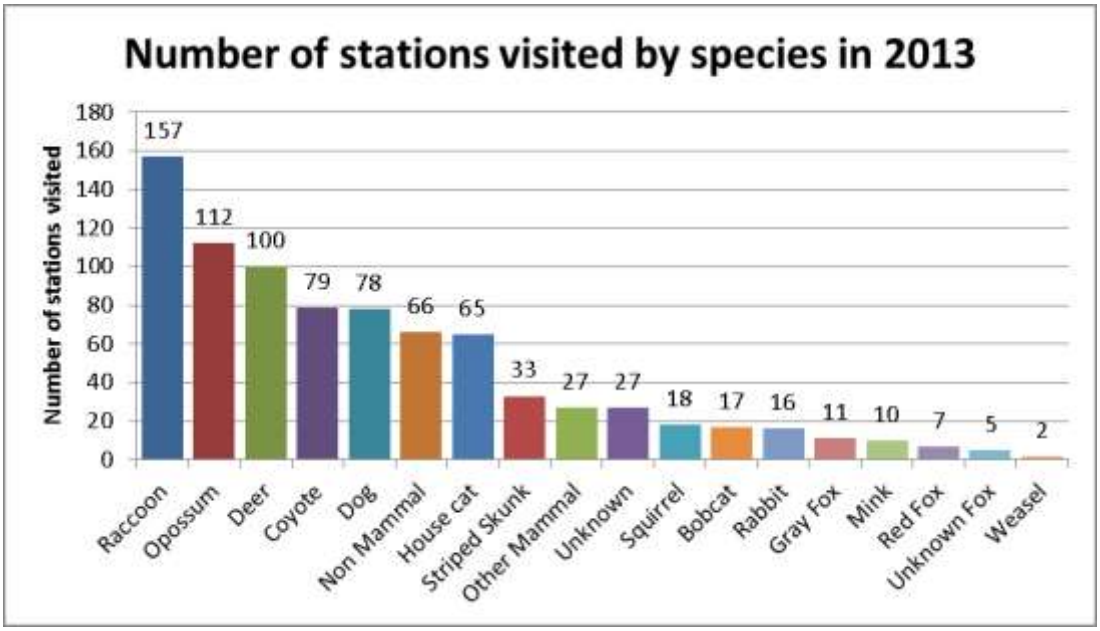

Figure 27. The number of stations visited by mammal species (including non-furbearers) out of 1097 operable stations in the 2013 survey.

Figures 28 through 31 show furbearer population trends based on the Furbearer Sign Station Survey, 1977-2013. Overall, trends indicate that most furbearer species have steady to slightly increasing populations. A slight downward trend is indicated for red and gray fox populations, which is also reflected in bowhunter observations and harvest records.

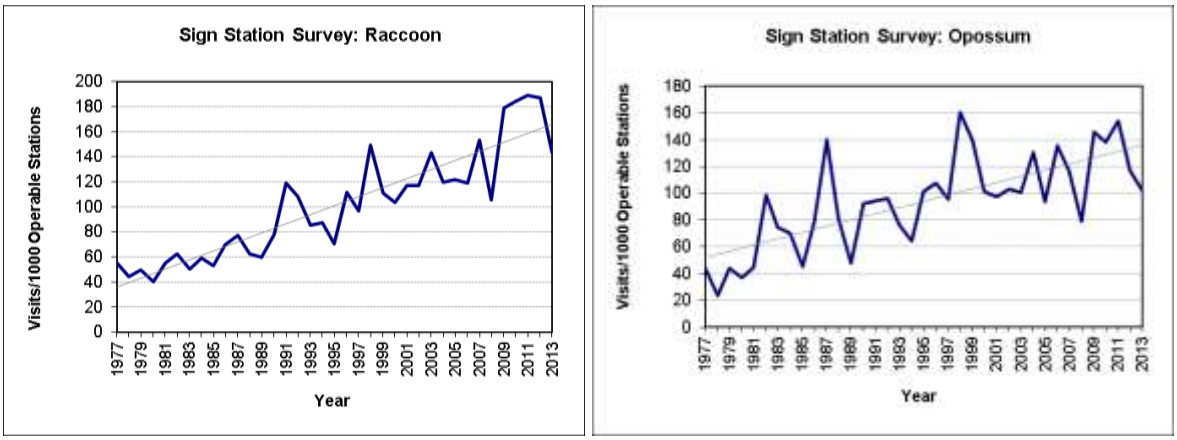

Figure 28. Raccoon and opossum population trends based on annual furbearer sign station survey.

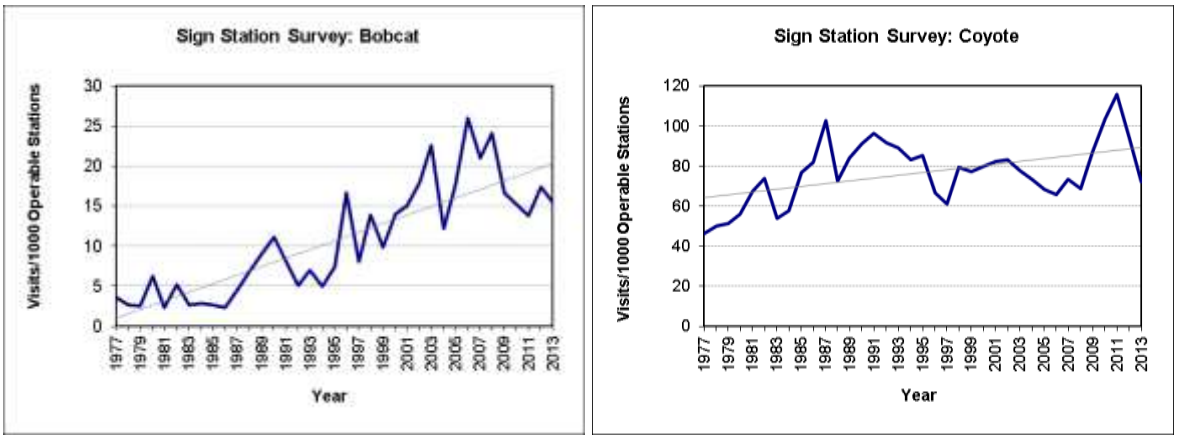

Figure 29. Bobcat and coyote population trends based on annual furbearer sign station survey.

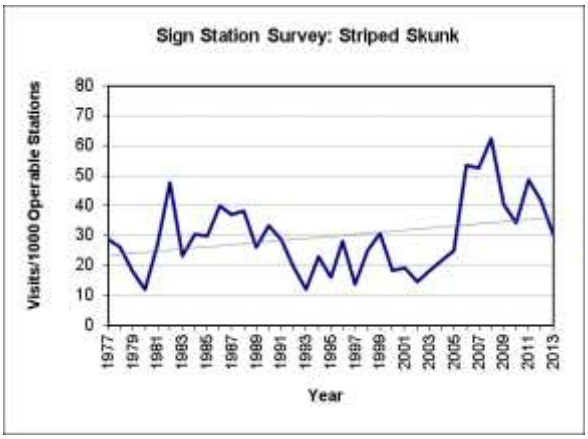

Figure 30. Skunk population trend based on annual furbearer sign station survey.

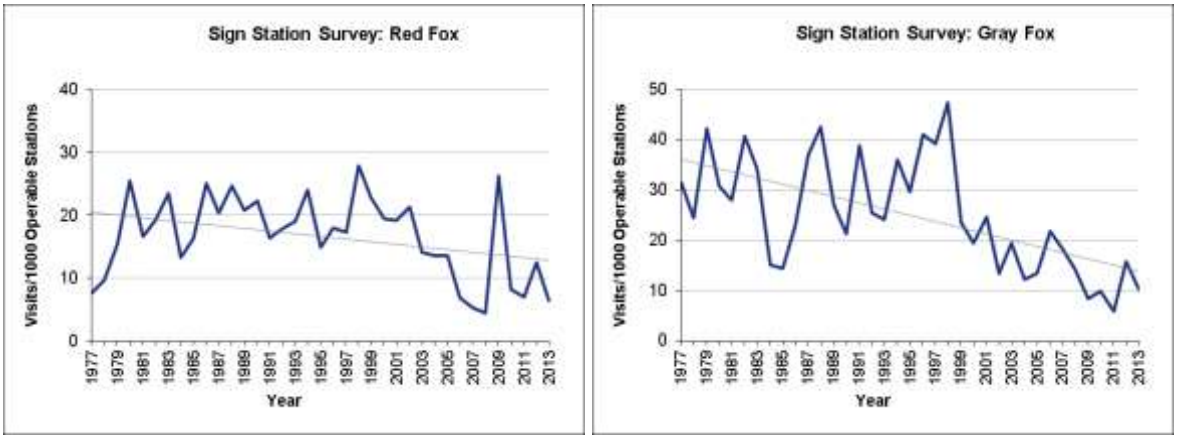

Figure 31. Red and gray fox population trends based on annual furbearer sign station survey.

ARCHER'S INDEX TO FURBEARER POPULATIONS

MONITORING FURBEARER TRENDS USING DATA GATHERED FROM COOPERATOR BOWHUNTERS

Introduction

The MDC has conducted annual surveys of wildlife populations via the bowhunters observation survey for 31 consecutive years (1983-2013). Each fall, several thousand archery deer and turkey hunters keep daily observation records for furbearers, other small game animals, deer and turkeys. Archers volunteer through post-season surveys, articles in the *Missouri Conservationist* magazine, and during sign-ups at bowhunter club meetings and other outdoor events. Archery hunters are asked to record the number of hours hunted, during both morning and evening hunts, and to use a standardized daily diary to record hours and sightings of wildlife. MDC uses the number of sightings of each species divided by the total number of hours hunted statewide to calculate a sighting rate, and this is then expressed as the number of sightings per 1,000 hunter hours to calculate population indices.

Wildlife population indices calculated from archer's diaries are useful trend indicators for terrestrial wildlife such as, coyotes, raccoons, foxes, bobcats, squirrels, white-tailed deer, and turkeys. Hunters are well distributed statewide, with volunteers in 113 of the 114 counties during most years. Hunters averaged 53,275 hours in the stand over the last 30 years, and they ranged from a low of 30,990 in 1985 and a high of 84,497 in 1988 (Table 8).

Table 8. Hunter hours and furbearer population indices based on archer's diaries, 1983-2013.

Years	Hunter Hours	Coyote	Red Fox	Gray Fox	Bobcat	Raccoon	Opossum	Striped Skunk	Mink	Beaver	Muskrat	Weasel	Badger	Otter	Black Bear
1983	55,374	20.0	6.5	5.1	1.7	23.8	12.6	5.0	0.7	0.3	0.5	0.1	0.1	0.0	0.0
1984	32,746	18.8	6.8	3.1	1.2	16.9	6.4	3.5	0.3	0.3	0.1	0.0	0.1	0.0	0.0
1985	30,990	20.1	5.3	2.8	1.5	15.4	8.6	4.2	0.5	0.4	0.4	0.1	0.1	0.1	0.0
1986	51,727	23.5	5.7	2.8	1.5	15.3	6.9	3.5	0.3	0.4	0.0	0.0	0.0	0.0	0.0
1987	57,457	23.5	4.5	2.5	2.0	23.3	10.1	3.0	0.3	0.7	0.2	0.1	0.1	0.1	0.0
1988	84,497	22.4	4.7	2.4	1.7	16.7	4.8	2.7	0.3	0.6	0.1	0.0	0.1	0.1	0.0
1989	72,992	21.1	5.1	2.4	1.8	19.6	5.6	3.5	0.1	0.6	0.1	0.0	0.2	0.1	0.0
1990	72,227	23.6	4.9	2.3	2.9	24.0	7.2	3.5	0.2	0.4	0.1	0.0	0.1	0.1	0.0
1991	64,434	26.1	4.7	3.0	3.3	30.5	11.7	4.0	0.3	0.3	0.1	0.0	0.1	0.0	0.1
1992	64,452	22.5	4.7	2.3	2.9	24.3	8.9	2.8	0.6	0.7	0.1	0.0	0.1	0.3	0.0
1993	53,857	19.7	4.2	2.1	3.2	28.1	7.7	3.7	0.2	0.5	0.2	0.0	0.1	0.3	0.0
1994	49,102	21.0	5.1	2.0	3.4	32.0	7.6	3.2	0.1	0.5	0.2	0.0	0.2	0.2	0.0
1995	66,106	22.3	4.6	2.1	3.8	36.5	9.6	3.6	0.1	0.3	0.1	0.0	0.1	0.3	0.1
1996	60,077	19.6	4.5	1.8	4.1	29.7	6.6	2.7	0.0	0.3	0.0	0.0	0.1	0.5	0.0
1997	47,816	18.0	4.0	2.0	4.5	31.2	7.4	2.7	0.1	0.4	0.0	0.0	0.1	0.6	0.0
1998	43,152	20.8	4.1	2.4	4.4	33.0	10.6	4.2	0.1	0.3	0.1	0.0	0.2	0.3	0.1

Years	Hunter Hours	Coyote	Red Fox	Gray Fox	Bobcat	Raccoon	Opossum	Striped Skunk	Mink	Beaver	Muskrat	Weasel	Badger	Otter	Black Bear
1999	44,012	29.2	3.7	2.2	4.8	45.9	12.5	4.0	0.2	0.3	0.1	0.0	0.1	0.5	0.0
2000	50,795	20.0	3.7	2.0	4.9	32.1	8.1	3.3	0.0	0.2	0.0	0.0	0.1	0.3	0.0
2001	47,023	19.5	3.6	2.1	5.2	38.7	8.2	4.7	0.1	0.4	0.0	0.0	0.1	0.3	0.0
2002	42,826	24.6	3.8	1.5	7.9	42.6	14.4	5.6	0.3	0.1	0.0	0.0	0.1	0.8	0.1
2003	39,964	20.5	2.7	1.5	6.0	37.9	7.2	3.2	0.1	0.1	0.0	0.0	0.2	0.6	0.0
2004	35,071	17.6	2.8	1.1	4.7	37.3	7.9	2.6	0.1	0.1	0.1	0.0	0.1	1.2	0.0
2005	68,440	21.2	2.8	1.3	5.6	37.3	8.5	2.5	0.1	0.3	0.0	0.0	0.1	0.5	0.0
2006	60,040	22.2	3.2	1.3	6.9	54.4	14.4	3.8	0.3	0.2	0.0	0.0	0.1	0.5	0.0
2007	50,390	19.8	3.0	1.5	5.2	40.0	9.4	4.0	0.0	0.1	0.0	0.0	0.1	0.4	0.0
2008	44,471	16.3	2.6	1.2	5.0	41.5	7.8	3.7	0.1	0.1	0.1	0.0	0.4	0.3	0.0
2009	44,919	20.6	2.6	1.2	4.9	42.0	12.4	4.4	0.1	0.1	0.1	0.0	0.2	1.2	0.1
2010	42,907	27.1	2.1	1.0	5.9	60.6	12.9	3.1	0.2	0.1	0.0	0.0	0.2	0.7	0.0
2011	41,370	26.1	2.7	1.1	6.6	70.1	16.6	4.6	0.2	0.1	0.1	0.0	0.2	0.9	0.1
2012	68,674	24.4	3.6	1.4	5.3	45.8	7.1	5.6	0.1	0.1	0.0	0.0	0.3	1.1	0.0
2013	63,621	16.2	2.1	1.4	4.0	33.3	5.7	2.9	0.1	0.2	0.1	0.0	0.1	0.6	0.1

Line graph representations of archer indices for several furbearer species are shown in Figure 32. Based on these indices, long term raccoon, bobcat and opossum observations suggest population increases. Striped skunk and coyote populations are relatively steady, while observations suggest a downward trend for red and gray fox populations. Wildlife population indices are also depicted by county (Table 9).

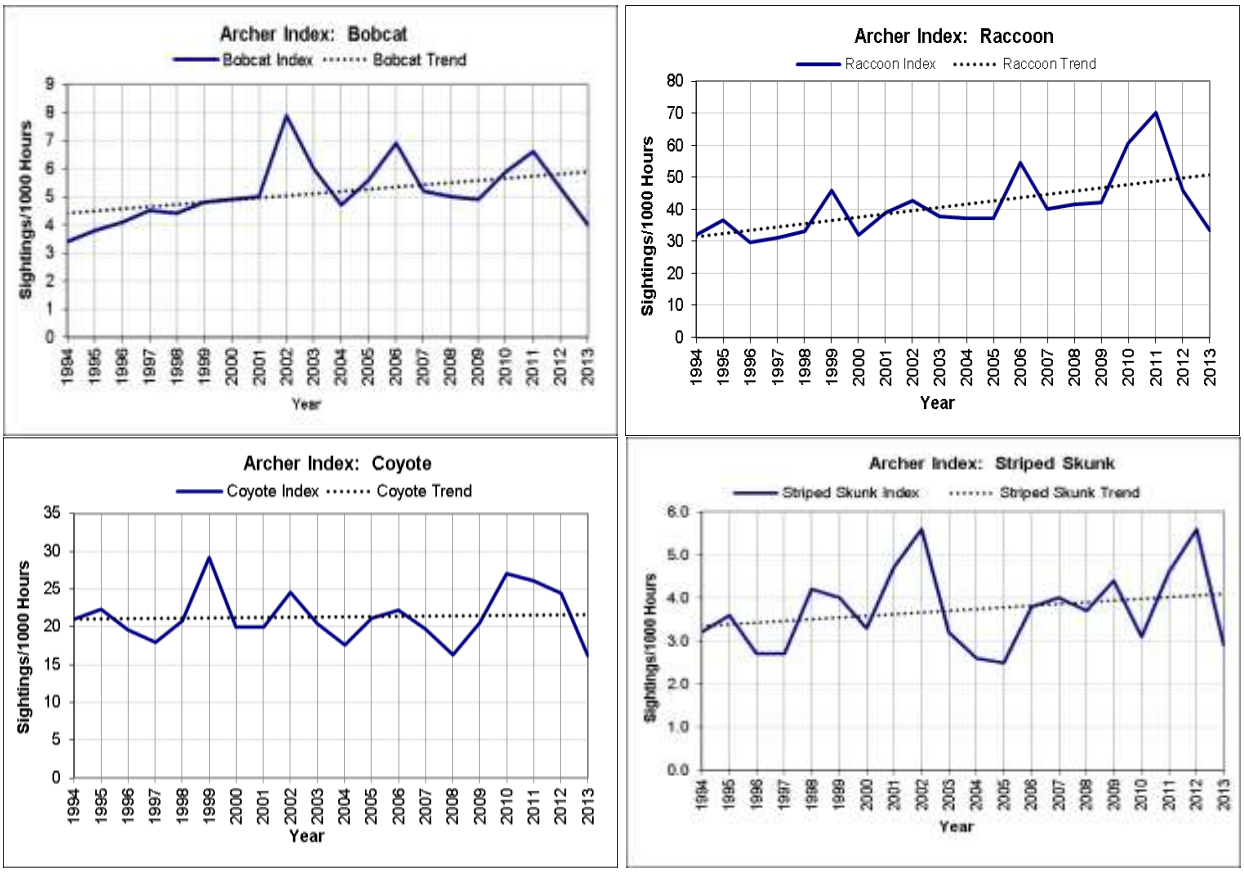

Figure 32. Population trends of some furbearing species based on archer observations.

Figure 32 (continued). Population trends of some furbearing species based on archer indices.

Table 9. County wildlife Indices for 2013 based on sightings by cooperator archery hunters (sightings/1,000 hours)

County	Coyote	Deer	Turkey	Raccoon	Opossum	Red Fox	Gray Fox	Bobcat	Badger	Bear
Adair	27	1125	281	33	8	3	2	3	0	0
Andrew	33	1505	620	62	8	4	0	0	0	0
Atchison	45	1303	1393	0	0	0	0	23	0	0
Audrain	16	967	331	99	3	2	5	0	0	0
Barry	12	539	307	32	6	0	0	8	0	0
Barton	31	1570	559	47	21	4	2	10	0	0
Bates	21	637	158	34	14	0	0	27	0	7
Benton	2	613	289	17	0	0	0	3	0	0
Bollinger	8	584	197	14	0	0	0	5	0	0
Boone	16	812	269	25	4	7	3	0	0	0
Buchanan	45	817	170	85	15	0	0	15	0	0
Butler	5	679	59	21	0	0	0	0	0	0
Caldwell	26	754	390	72	0	0	0	5	0	0
Callaway	11	823	209	13	2	6	0	2	0	0
Camden	16	917	348	45	0	22	8	8	0	0
Cape Girardeau	34	536	470	38	6	4	2	9	2	0
Carroll	20	926	161	156	5	0	5	5	0	0
Carter	4	369	67	22	4	0	14	7	0	0
Cass	40	527	409	36	17	5	0	7	0	0
Cedar	7	728	935	7	0	0	0	11	0	0
Chariton	24	857	96	58	0	2	0	9	0	0
Christian	17	534	464	0	0	0	0	3	0	0
Clark	9	859	333	30	8	0	0	1	0	0
Clay	5	1188	284	51	8	0	0	5	0	0
Clinton	0	1210	131	98	0	0	0	0	0	0
Cole	6	343	113	61	0	6	0	0	0	0
Cooper	21	698	319	62	5	2	0	2	0	0
Crawford	1	492	264	4	1	0	10	8	0	0
Dade	14	573	150	25	0	0	0	14	0	0
Dallas	6	604	424	2	0	0	0	6	0	0
Davies	11	565	341	57	11	0	0	0	0	0

County	Coyote	Deer	Turkey	Raccoon	Opossum	Red Fox	Gray Fox	Bobcat	Badger	Bear
Dekalb	38	725	167	33	5	5	3	13	0	0
Dent	6	511	246	6	0	0	0	0	0	0
Douglas	4	493	409	13	0	0	0	0	0	0
Dunklin	10	153	0	48	29	0	0	10	0	0
Franklin	7	591	400	22	3	2	1	1	0	0
Gasconade	22	759	325	20	6	0	0	0	0	0
Gentry	40	887	182	85	36	0	0	0	0	0
Greene	0	809	655	22	4	0	4	4	0	0
Grundy	0	548	238	0	0	0	0	0	0	0
Harrison	12	1728	126	51	6	6	0	3	0	0
Henry	18	773	364	46	4	8	0	7	0	0
Hickory	16	735	264	4	2	2	0	0	0	0
Holt	56	1141	701	51	8	0	0	0	0	0
Howard	7	913	512	102	11	0	0	8	0	0
Howell	44	630	385	2	2	0	0	10	0	0
Iron	9	279	140	9	0	0	0	0	0	0
Jackson	12	672	215	27	12	2	0	2	0	0
Jasper	12	939	583	67	4	0	0	8	0	0
Jefferson	8	419	63	21	2	3	2	0	0	0
Johnson	39	773	332	49	11	6	0	7	0	0
Knox	25	1121	430	63	30	0	1	1	0	0
Laclede	14	735	520	11	3	0	8	8	0	0
Lafayette	29	720	316	58	4	0	0	4	0	0
Lawrence	39	836	577	16	3	0	16	3	0	0
Lewis	13	782	170	52	7	0	3	0	0	0
Lincoln	10	565	151	17	3	4	0	0	0	0
Linn	30	1637	326	87	6	0	0	0	0	0
Livingston	5	730	576	34	5	0	0	5	0	0
McDonald	15	522	16	17	5	0	0	7	0	0
Macon	15	679	229	42	10	1	2	6	1	0
Madison	8	526	323	13	0	3	0	8	0	0
Maries	8	569	424	8	3	0	0	0	0	0
Marion	17	956	403	23	11	3	0	1	0	0
Mercer	6	1403	358	7	20	0	0	3	0	0
Miller	0	687	239	24	3	0	3	0	0	0
Mississippi	17	750	117	0	0	0	0	0	0	0
Moniteau	31	992	2326	109	0	0	0	0	0	0
Monroe	11	514	383	43	5	0	0	3	0	0
Montgomery	13	649	370	25	1	1	0	1	0	0
Morgan	4	546	109	6	4	0	0	2	0	0
New Madrid	0	0	0	0	0	0	0	0	0	0
Newton	7	666	169	6	1	0	0	7	0	0
Nodaway	43	858	268	174	25	8	0	3	3	0
Oregon	0	773	62	9	0	0	0	4	0	4
Osage	24	1348	514	2	2	0	0	2	0	0
Ozark	21	672	290	14	3	6	0	6	0	6
Pemiscot	0	0	0	0	0	0	0	0	0	0
Perry	8	753	284	8	3	0	0	6	0	0

County	Coyote	Deer	Turkey	Raccoon	Opossum	Red Fox	Gray Fox	Bobcat	Badger	Bear
Pettis	23	709	368	62	4	0	0	2	0	0
Phelps	4	370	258	20	1	0	1	2	0	0
Pike	18	658	214	21	5	2	0	0	0	0
Platte	27	928	263	107	18	2	2	0	2	0
Polk	20	776	494	27	5	2	57	0	0	0
Pulaski	4	401	395	31	4	4	4	12	0	0
Putnam	21	834	203	54	9	0	1	6	0	0
Ralls	73	1800	256	47	4	0	1	6	0	0
Randolph	29	902	341	92	27	2	2	14	0	0
Ray	38	652	329	55	12	0	0	12	0	0
Reynolds	3	412	118	0	0	0	0	5	0	0
Ripley	21	728	235	29	12	0	0	4	0	0
St Charles	11	822	248	14	4	1	0	3	0	0
St Clair	7	641	391	12	5	0	0	0	0	0
St Francois	3	320	248	0	3	3	2	5	0	0
St Genevieve	8	453	214	11	1	0	0	3	0	0
St Louis	19	1094	209	22	1	8	0	1	0	0
Saline	19	568	255	73	8	0	0	5	0	0
Schuyler	34	487	240	105	22	0	0	0	0	0
Scotland	14	767	240	57	5	5	0	0	2	0
Scott	0	667	61	0	0	0	0	0	0	0
Shannon	14	320	390	5	0	0	0	16	2	0
Shelby	20	903	303	42	0	5	0	2	0	0
Stoddard	7	766	263	25	0	7	0	5	0	0
Stone	5	266	8	5	0	0	0	5	0	0
Sullivan	35	978	635	41	9	0	0	0	0	0
Taney	5	768	422	0	0	0	0	0	0	0
Texas	13	492	178	23	0	0	2	2	0	0
Vernon	14	788	464	63	20	5	2	7	0	0
Warren	8	870	191	5	7	4	0	0	0	0
Washington	0	79	372	0	0	0	0	6	0	0
Wayne	7	500	71	18	3	0	6	7	0	0
Webster	10	427	243	12	7	0	0	2	0	0
Worth	101	1813	609	197	67	10	0	5	0	0
Wright	6	867	567	22	0	0	0	11	0	0
State-wide Index	16	743	298	33	6	2	1	4	0	0

BADGER STATUS IN MISSOURI

AN EXPLORATORY ASSESSMENT OF BADGER DEMOGRAPHICS AND CONSERVATION STATUS IN MISSOURI

The badger is uncommon in Missouri and is considered a species of conservation concern. Its official rank is Unrankable (SU), however, as little data are available to form the basis for a ranking. MDC's current study is designed to collect badger observations and specimens from across the state. The information will be used to better understand the demographics and distribution of badgers in Missouri and to provide data from which to refine the status of badgers in Missouri.

The badger is a harvested species in Missouri, but harvest numbers have historically been low (generally fewer than 200 per year since the 1960s, and fewer than 100 per year since the 1990s). Arkansas ranks the species as S1 (Critically Imperiled), Ohio and Indiana as S2 (Imperiled), and Kansas as S3 (Vulnerable). Iowa ranks the badger as S4 (Apparently Secure), reflecting their apparent increased abundance in the grassland and open habitats that dominate the state. This habitat preference is also seen in Missouri, as the majority of harvested animals are from the northern portion of the state, and especially from northwestern Missouri.

Badger habitat has declined substantially in areas converted from grassland to intensive agriculture. Also, colonial rodents such as prairie dogs and ground squirrels (as in Missouri, where both Franklin's and thirteen-lined ground squirrels are also species of conservation concern) have been reduced or eliminated. Assessing the range and demographics of badgers in Missouri is hindered by a lack of information because 1) harvest data are insufficient to properly assess trends and 2) little baseline data are available on the biology and demographics of the species. MDC is using verified sightings from the public to define the minimum range of badgers in Missouri, to make initial and preliminary insights into the demographics of the Missouri population and to better refine the status of the species in MDC's heritage database.

Preliminary Results

Since May 2010 we have received 328 badger reports. Physical data from badger carcasses collected in Missouri through June of 2014 show an average whole carcass weight of 16.7 lbs. (n = 32) and an average length of 25 in (n = 30). Data for the carcasses that were received already skinned show an average weight of 13.2 lbs. (n = 58) and a length of 23.6 in (n = 56). Each carcass collected had a tooth extracted and sent in for aging. Almost one-half (44%) of badgers collected were less than 1-year-old (Figure 33).

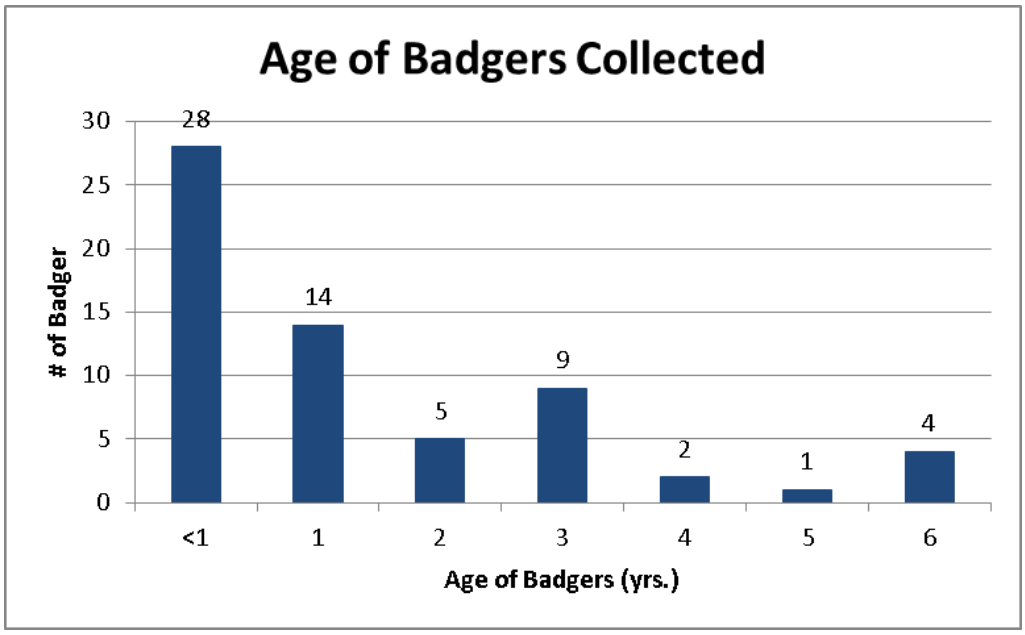

Figure 33. Age of badgers collected from 2010-2013

Data collected during this study were used to study the relationship between habitat and badger occurrence in Missouri. Badger observations were compared to land cover, elevation and soil type. Habitat characteristics associated with badger observations were then compared to habitat across the state. Results showed that 78 percent of observations occurred in grassland or cropland (Figure34), 64 percent of observations occurred in residium and glacial drift soils (Figure 35) and 71 percent of observations occurred between 623 and 1016 feet elevation (Figure 36).

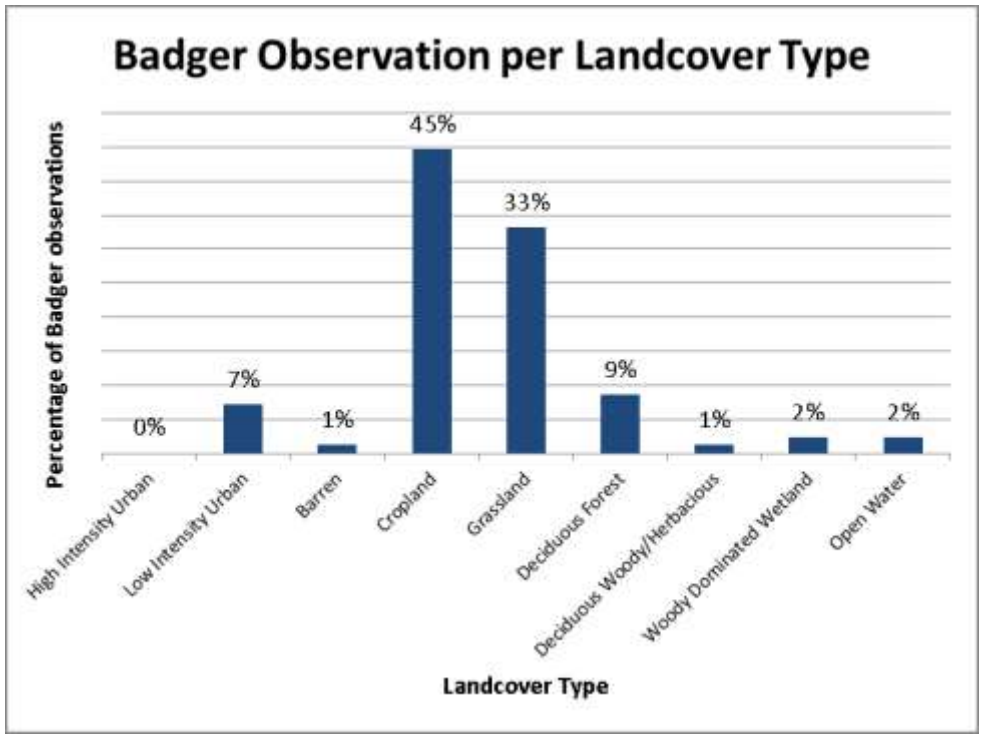

Figure 34. Percentage of badger observations per landcover type in Missouri.

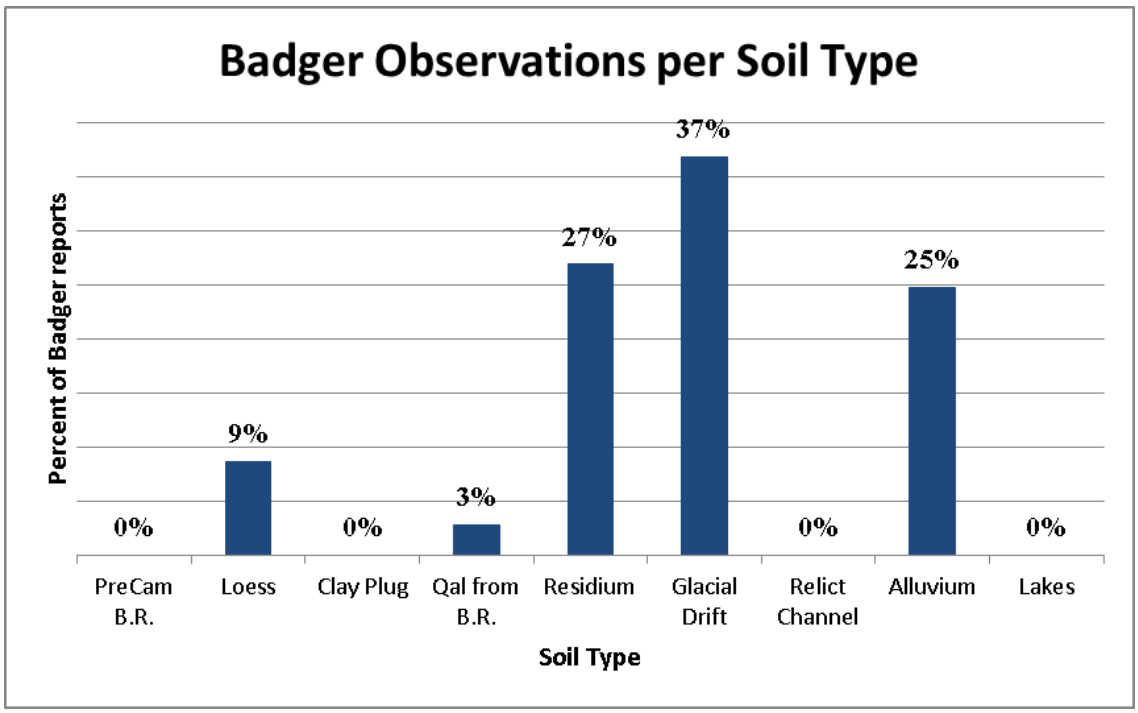

Figure 35. Percentage of badger observations per soil type in Missouri.

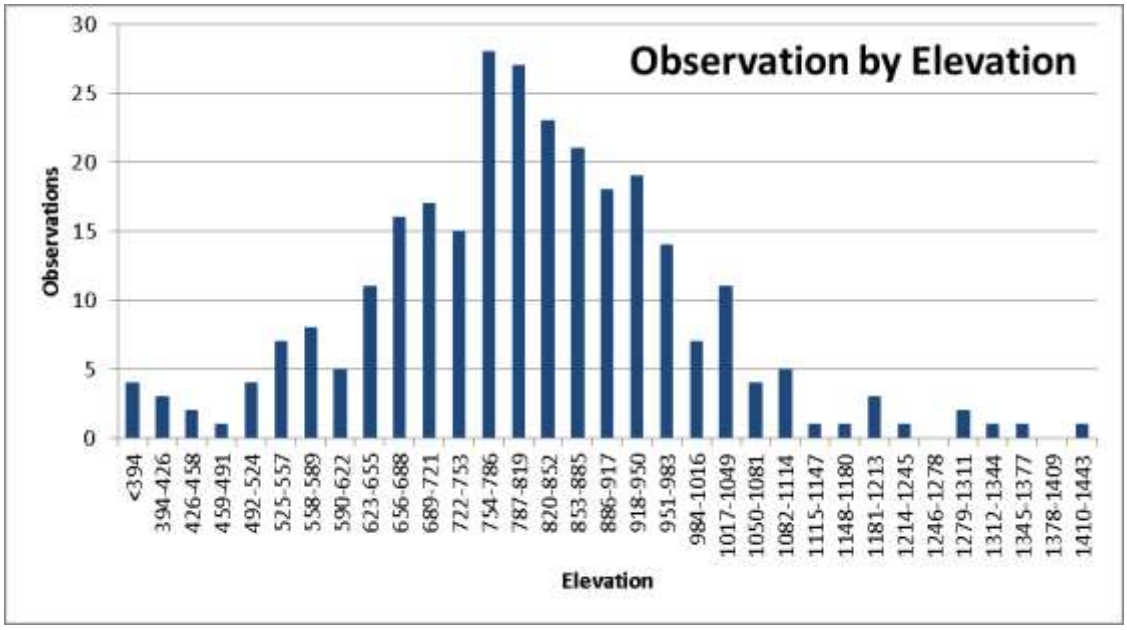

Figure 36. Badger observations compared to elevation in Missouri.

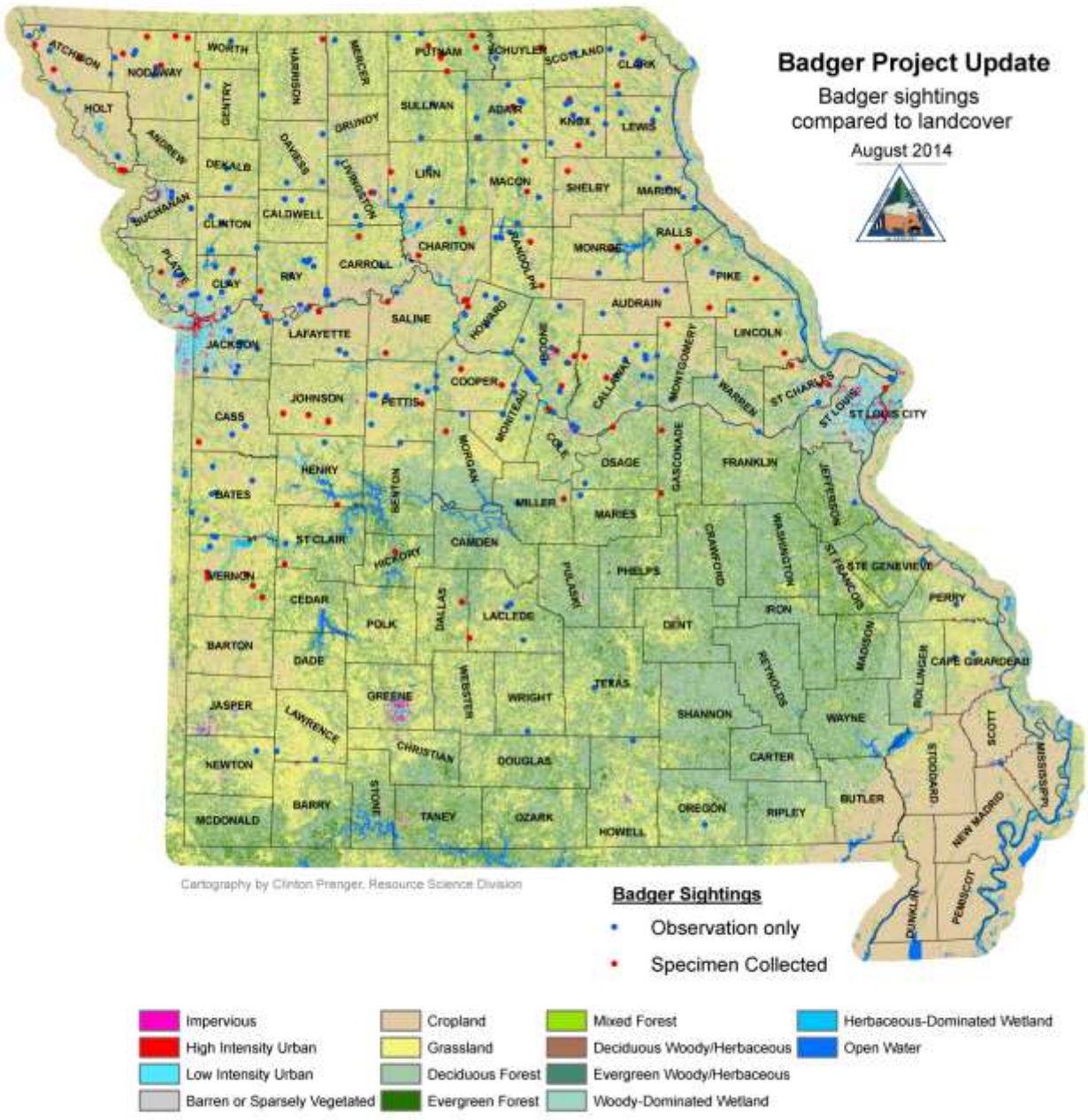

Figure 37. Badger locations based on reported sightings and carcass recoveries from trappers and road killed animals.

MONITORING AND DEMOGRAPHIC ASSESSMENT OF RIVER OTTERS AND BOBCATS IN MISSOURI

Currently, Missouri has no harvest level restrictions on river otters or bobcats. Past harvest data suggest these species are not in danger of being overharvested. However, harvest of these species has been challenged in a number of states. Plaintiff's have alleged state agencies lacked sufficient data to allow harvest at current levels. In order to obtain a better idea of the age and sex characteristics of statewide populations of river otters and bobcats, as well as to legally defend our harvest if needed, the MDC began a research project to document the sex and age of harvested animals and measure harvest effort by trappers for these species. These and other data will enable us to generate abundance estimates and measure the impact of harvest and regulations on otter and bobcat populations.
Statistical Population Reconstruction (SPR) provides a broad scale assessment whereas most other techniques are applicable to only local areas. Through SPR, the MDC will have a better understanding of the relationship between harvest rates and demographics of each species. Population reconstruction will also provide the MDC with solid harvest and population data. This format will be the MDC's long-term monitoring plan.
Tooth envelopes and survey packets are sent to Missouri trappers at the beginning of each trapping season. These packets contain a monthly journal to aid trappers in recording effort or trap-nights per captured animal. Trapnights per capture will reveal the amount of trapping pressure these species undergo each year. Trappers are also being asked to remove one of the lower canine teeth from each otter and bobcat they harvest. We then determine age-at-harvest for each harvested animal. This allows a determination on if the population is increasing, decreasing or stable. The effort survey and teeth are collected when hunters and trappers register their animals with Conservation personnel for CITES purposes. See figures 38 and 41 for initial age analysis of samples for the 2013-2014 season. In total, 962 lower canine teeth were collected from both river otters and bobcats with 62 samples being excluded from analysis because they were cut too short or the wrong tooth was sent in for aging. The samples consisted of 482 teeth being from river otters and 418 being from bobcats.

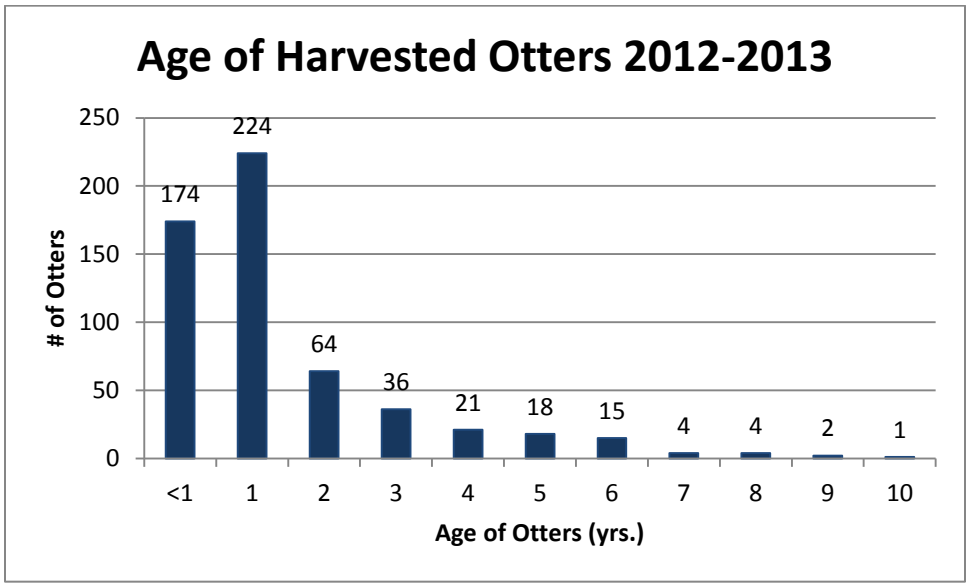

Figure 38. Age of otters sampled 2012-2013.

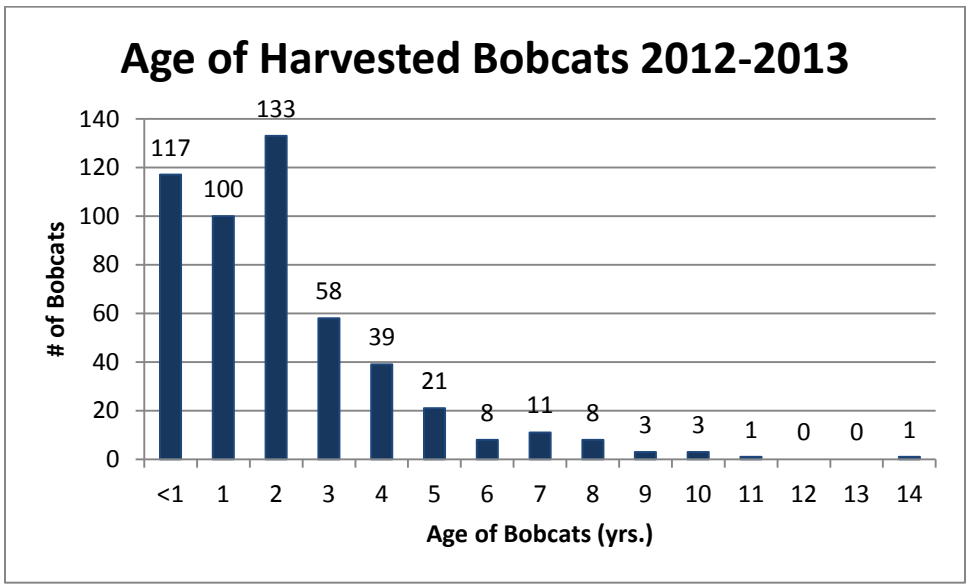

Figure 39. Age of bobcats sampled 2012-2013.

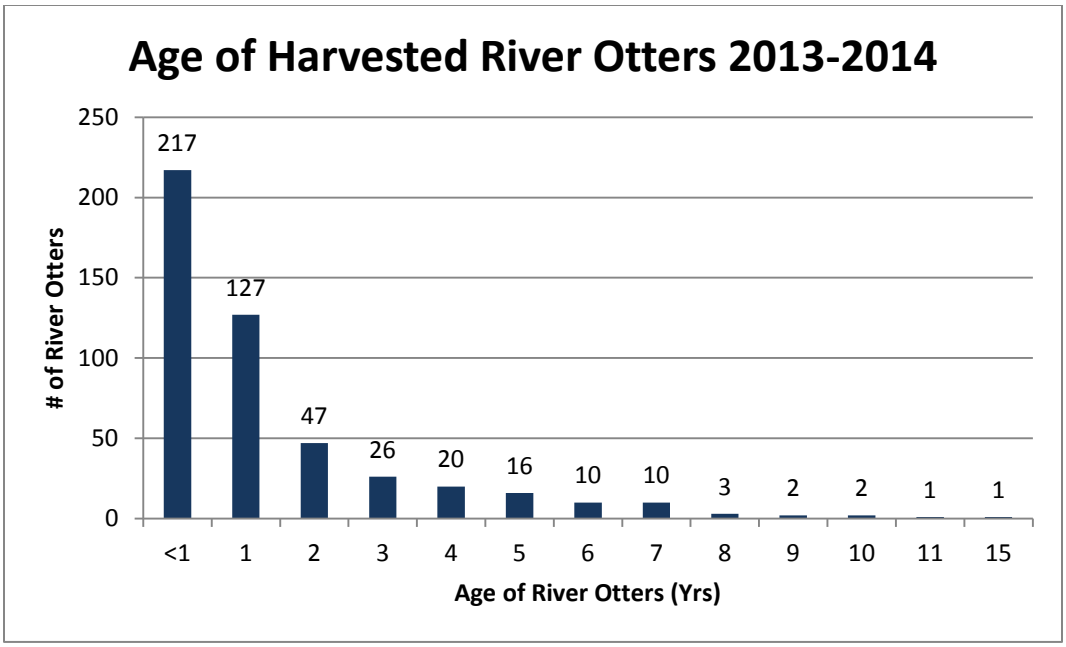

Figure 40. Age of otters sampled 2013-2014.

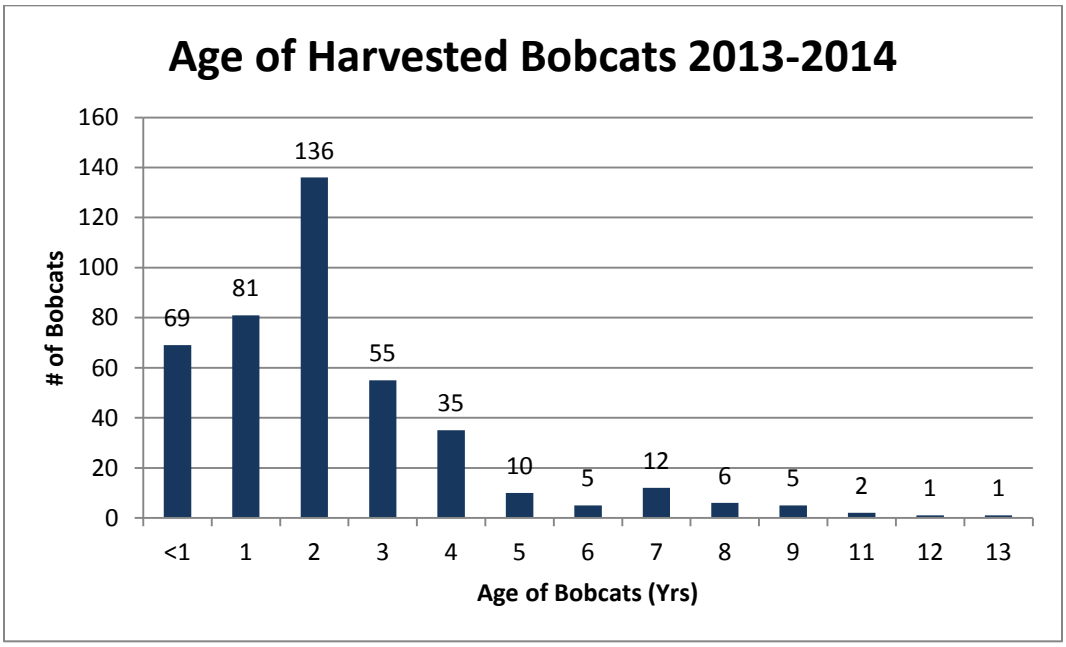

Figure 41. Age of bobcats sampled 2013-2014.

LARGE CARNIVORE INVENTORY

LARGE CARNIVORE INVENTORY AND MARKING STUDY:

Background

Dangerous captive animals have recently come under public scrutiny. Because of the inherent danger and potential liability associated with the possession of large carnivores, an effective system was needed to verify ownership and better monitor the legitimate purchase, sale and trade of these animals. The Department of Agriculture is currently evaluating regulations for the possession of dangerous carnivores other than those regulated by MDC. The MDC has taken a proactive approach in response to the public demand for more accountability and to provide some consistency between us and the Department of Agriculture. The intent of these new provisions is to better enable our enforcement and record keeping obligations, safeguard permit holders from false claims of ownership, and satisfy public demand for higher accountability of these potentially dangerous animals. In addition, our Department will have the ability to distinguish captive animals from truly wild animals.

Based on these issues, MDC made significant regulation changes pertaining to large carnivores owned under the Class II Wildlife Breeder Permit. The proposal to permanently mark all captive bears, mountain lions, wolves and wolf hybrids was approved by the Regulations Committee and Conservation Commission in 2007. The regulation became effective March 1st, 2008 under code: 3 CSR 10-9.353 Privileges of Class I and Class II Wildlife Breeders and had a 1 July 2008 compliance date. Effective July 1, 2008, all mountain lions, black bears, wolves and wolf-hybrids held under the privileges of a Class II Wildlife Breeder Permit were required to be uniquely identified with a permanent Passive Integrated Transponder (PIT) microchip. These microchips are about the size of a grain of rice and contain an electromagnetic code that can be used to identify animals. They can be injected under the skin to permanently mark animals without altering external appearance. Microchips are normally placed just under the skin along the back of the animal, between the shoulder blades. This standardized protocol allows animals to be searched quickly and efficiently. The regulation also requires owners to allow the Department to obtain, from each animal, a small blood or tissue sample sufficient for DNA analysis.

Progress to Date

Surveys and interviews were completed for 33 of the then 50 captive carnivore owners in the state. Feedback from the interviews showed that a majority of owners are generally supportive of the new regulations, but have concerns about the welfare of their animals. An informational workshop was held in Jefferson City on February 9, 2008. The workshop provided a forum for MDC personnel, veterinarians and captive carnivore owners to discuss the procedures for marking captive animals. The contract with Wildlife Genetics International for DNA testing was finalized in May 2008, renewed in April 2009, 2010, and again in April 2011. DNA samples will be stored at Resource Science in Columbia until all samples have been collected and then will be sent to Wildlife Genetics International for analysis.

Department personnel have assisted in implanting microchips in and collecting DNA samples from 178 different animals at 46 facilities around the state. A total of 35 mountain lions, 34 black bears, 53 wolves and 56 wolf hybrids have been tagged. As of June 2014, all known owners of captive carnivores are in compliance with the regulation. All permits to hold large carnivores expire June 30th of each year. Renewal letters and applications were sent to all current permit holders in April and May 2014. If the permits are not renewed by their expiration date, the permit holder is considered to be in violation of Missouri state code. Permit holders in violation may receive a citation from their local conservation agent if they wish to continue to hold large carnivores.

MOUNTAIN LION RESPONSE TEAM

The Missouri Department of Conservation developed a Mountain Lion Response Team (MLRT) in 1996 to address the concerns and reports from the public regarding mountain lions and the occasional confirmed occurrence of a mountain lion in the state. The MLRT consists of 12 employees across the state. MLRT members have special qualifications or have received training to address mountain lion concerns and conduct investigations when evidence is present.

Mountain lion sightings are categorized and entered into a long-term database. The MLRT also keeps track of confirmed cases of mountain lions in Missouri when there is physical evidence to support a sighting such as a track, carcass, photo, video, etc. The MLRT has logged over 2,000 sightings in the database since 1994. There have been 48 mountain lion observations confirmed in the state (Table 10, Figure 42). Mountain lion confirmations continue to increase. Missouri has confirmed more mountain lion incidents than any other state without a known population. Lion confirmations in Missouri are the result of trail camera photos (75%), followed by DNA confirmation from hair, carcasses, and tracks. Genetic analysis from killed lions

indicated origins of South Dakota, Montana and Colorado; all DNA-confirmed animals were males. Although the sex and origin from only 4 of our 48 confirmations has been documented, the information does help explain some of what is likely happening with lions in Missouri – that being that the majority of confirmed reports result from transient subadult males. Learning the sex and origins of some lions has enabled MDC to provide the public and media with timely updates about mountain lion occurrences, factual information about individual animals, and general information about their biology and habits.

Recent lion incidents in Missouri and Oklahoma suggest that some of these lions may not be transients and may be establishing home ranges, thus suggesting the presence of a female lion. There have been 17 sightings in a six-county region including Shannon, Texas, Oregon, Carter, Ripley and Reynolds counties. There have been 13 sightings confirmed by photos, two by hair samples, and one each of a carcass and a live capture. Six months after the first sightings, a mountain lion was killed in Texas County that was physically different than the mountain lions that had been previously caught on game camera. During the summers of 2011 and 2012, multiple Shannon county lion photos and kill sites were investigated over a course of six months; some of the photos were collected from the same location. Similarly, multiple lion photographs were collected over a six month period from a central Oklahoma location. This past winter a female lion was aerially gunned by USDA APHIS near the same Oklahoma area.

During this past year, over 100 reports of mountain lions were recorded in the state. This is a minimum number because many reports to local agency staff are not recorded. Most reports are the result of the MLRT website reporting form and email account. The MLRT confirmed three mountain lion sightings this past year.

Table 10. Confirmed Instances of Mountain Lions in Missouri.

2014- June Oregon County	48 Photo of mountain lion taken by motion-activated game camera
2013-October Barry County	47 Photo of mountain lion taken by motion-activated game camera
2014-March Carter Co	46 Photo of mountain lion taken by motion-activated game camera
2013-November Madison Co	45 Photo of mountain lion taken by motion-activated game camera
2013-October Reynolds Co	44 Photo of mountain lion taken by motion-activated game camera
2013-October Shannon Co	43 Photo of mountain lion taken by motion-activated game camera
2013 - September Carter Co	42 Photo of mountain lion taken by motion-activated game camera
2013 – August Pulaski Co	41 Photo of mountain lion taken by motion-activated game camera
2013 - February Carter Co	40 Photo of mountain lion taken by motion-activated game camera
2013 - January Warren Co	39 Photo of mountain lion taken by motion-activated game camera
2012 – December Warren Co	38 Photo of mountain lion taken by motion-activated game camera (photo taken during the same time period as the other Warren county confirmation. Likely the same animal.)
2012 - December Carter Co	37 Photo of mountain lion taken by motion-activated game camera
2012 - December DeKalb Co	36 Photo of mountain lion taken by motion-activated game camera
2012 - November Taney Co	35 Photo of mountain lion taken by motion-activated game camera
2012 - October Ripley Co	34 Photo of mountain lion taken by motion-activated game camera

2012 - October Shannon Co	33 Photo of mountain lion taken by motion-activated game camera
2012 - September Shannon Co	32 Photo of mountain lion taken by motion-activated game camera
2012 - September Grundy Co	31 Photo of mountain lion taken by motion-activated game camera (Photo taken in April, near to and soon after previous Grundy county confirmation, not submitted until September.)
2012 - September Shannon Co	30 Photo of mountain lion taken by motion-activated game camera
2012 - April Grundy Co	29 Photo of mountain lion taken by motion-activated game camera
2012 - February Reynolds Co	28 Photo of mountain lion taken by motion-activated game camera
2012 - January Reynolds Co	27 Citizen captured live mountain lion in live trap. Mountain lion was tranquilized, measured, weighed and released.
2011 - September Gasconade Co	26 Citizen reported seeing mountain lion. Hair sample collected. DNA confirmed.
2011 - September Carter Co	25 Citizen reported seeing mountain lion. Hair sample collected. DNA confirmed.
2011 - September Reynolds Co	24 Photo of mountain lion taken by motion-activated game camera
2011 - September Wayne Co	23 MDC employee reported mountain lion tracks in roadway. MLRT investigation confirmed.
2011 - September Shannon Co	22 Photo of mountain lion taken by motion-activated game camera
2011 - September Texas Co	21 Sub adult male shot by landowner. No obvious signs of confinement.
2011 - September Shannon Co	20 Photo of mountain lion taken by motion-activated game camera
2011 - August Oregon Co	19 Photo of mountain lion hindquarters taken by motion-activated game camera
2011 - August Shannon Co	18 Photo of probably subadult disperser taken by motion-activated game camera

2011 - April Macon Co	17 Citizen reported mountain lion tracks in creek bed. MLRT investigation confirmed.
2011 – March Oregon Co	16 Citizen reported observing a cat jump a fence. DNA analysis of hairs collected at the scene confirmed species, ancestry analysis underway.
2011 – February Linn Co	15 Photo of probably subadult disperser taken by motion-activated game camera
2011 – January Macon Co	14 Subadult male shot by coyote hunters. No obvious signs of confinement. DNA analysis indicated probable South Dakotan ancestry.
2011 – January St Louis Co	13 Photo of probable subadult disperser taken by motion-activated game camera.
2010 – December Ray Co	12 Subadult male shot by raccoon hunter. No obvious signs of confinement. DNA analysis indicated probable South Dakotan ancestry.
2010 – November Platte Co	11 Photo of probable subadult disperser taken by landowner. DNA analysis of hairs collected at the scene could not confirm ancestry.
2006 – December Livingston Co	10 Photo of probable subadult disperser taken by motion-activated game camera.
2006 – November Shannon Co	9 Deer carcass characteristic of mountain lion kill with tracks found nearby.
2003 – August Callaway Co	8 Approximately 1½-year-old male road kill. No obvious signs of confinement. All four toes and pad of left forepaw missing but healed over (dewclaw present); cause of injury unknown, but did not appear to be trap-related. Stomach and intestines contained remains of squirrel, rabbit, and white-tailed deer. DNA analysis indicated North American heredity.
2002 – October Clay Co	7 Two-to-three-year-old male road kill. No obvious signs of confinement. Intestines contained deer and raccoon hairs, and also man-made fibers. DNA analysis indicated North American heredity.
2001 – December Pulaski Co	6 Photo of probable subadult disperser taken by motion-activated game camera.
2000 – December Lewis Co	5 Video by deer hunter in a tree stand.
1999 – January Texas Co	4 Animal treed by rabbit hunters' dogs. Tracks in snow, and two deer carcasses characteristic of mountain lion kills found nearby.

1997 – January Christian Co	3 Video by property owner (obtained through Dr. Lynn Robbins at Missouri State University in Springfield). Animal's behavior suggested possible former captive.
1996 – November Reynolds Co	2 Night-time video by Conservation Agent of cat on deer carcass.
1994 – December Carter Co	1 Small adult female treed and shot (through the eye with a .22) by two raccoon hunters near Peck Ranch Conservation Area. Carcass was never recovered, but obtained photo of animal on truck tailgate. Federal authorities fined each hunter $2,000. In November 1998 a deer hunter found the skinned pelt of a small adult female with head and feet attached by a remote Texas County road. Pelt showed signs of freezer burn, and X-ray of skull revealed bullet fragments. Although likely the same animal, it cannot be confirmed absolutely.

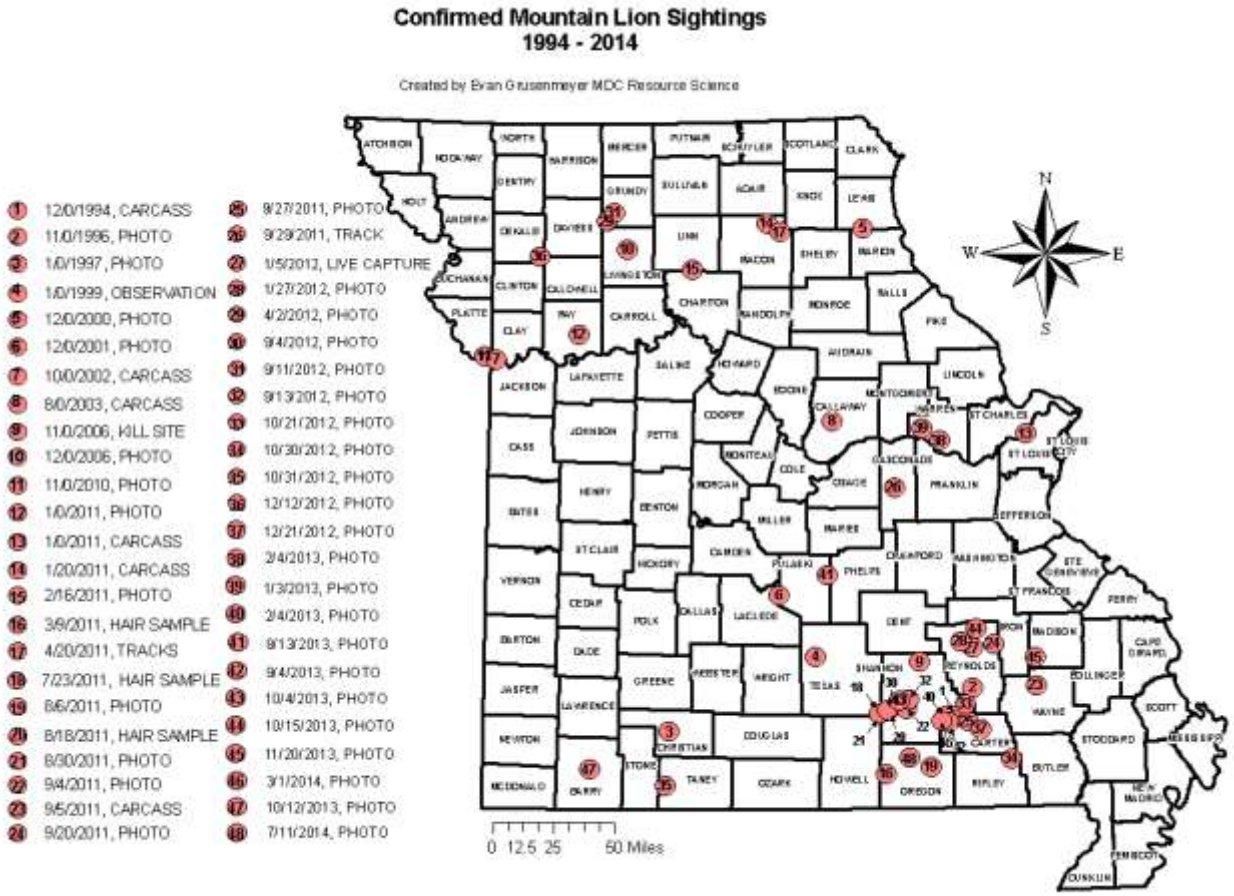

Figure 42. Confirmed locations and information for mountain lions in Missouri from 1994-2014.

DETERMINING ORIGIN, SEX, GENOTYPE, AND MOVEMENTS OF MOUNTAIN LIONS IN MISSOURI

There is mounting evidence that mountain lion populations are in the process of reclaiming former habitats in the Midwest. Given the numerous lion confirmations in Missouri, especially the southeastern Ozarks, there seems to be an attraction to this area and some lions appear to be establishing home ranges. In order to continue to learn about and monitor these animals we are using scat detection dogs to collect genetic materials in areas around confirmed sightings and will opportunistically capture and radio-mark lions with satellite equipped transmitters. Our investigations will reveal the sex, genotype, and origin of individual lions and reveal whether lions have established home ranges in the state. The information gained from this study will give us a clearer picture of what is happening with lions in Missouri. We currently do not know if we have detected one lion multiple times or ten different lions only once in any given time period. Identifying the sex of individual lions is important because finding a female suggests a strong chance for reproduction. Radio-marked animals will allow us to examine movement patterns and, over time habitat use, prey selection, and home range size or dispersal movements. We believe this information will give us a better understanding of the biology and ecology of lions in Missouri. When we are able to document female lions and/or reproduction lions will no longer be considered extirpated and we will draft a management plan for lions in a similar process as was conducted for black bears.

Our approach is to search areas around verified lion incidents with the aid of scat detection dogs trained for finding only lion scat. Dogs and their handler search areas around confirmed sightings. Collected scats are preserved and shipped to the USDA Wildlife Ecology Research Unit of the Rocky Mountain Research Station. Collected DNA is amplified and species, sex, and genotype are identified (Table11). To infer the source of these lions, genotypes will be compared with those in the laboratory's database. We will compare lion genetic samples collected in Missouri and those from surrounding states to quantify a minimum number of individual lions.

Capture and radio marking lions: We will opportunistically attempt to capture lions with walk-in cage traps, covered with vegetation to offer security and thermal cover; traps checked at 24 hour intervals. Captures sites will be around kill sites and potentially near locations for which we have confirmed a sighting. In some cases lions may be treed or bayed with trained dogs during November-March when conditions are suitable for tracking and trailing lions. For animals bayed in trees we will secure a 2.5 m radius nylon landing net to the base of the tree with the perimeter tied to adjacent trees and positioned >1m above ground to prevent injury to the animal if it falls. We will climb the tree and attach a rope to the animal's foot and lower sedated animals to the ground. Captured lions will be immobilized with concentrations of 200 mg/mL of ketamine hydrochloride and 20 mg/mL of xylazine hydrochloride at doses of 12 mg/kg of estimated body weight (Ross and Jalkotzy 1992, Logan et al. 1996, Spreadbury et al. 1996). Immobilization drugs will be administered from 3.0-cc darts fired from a CO_2 powered dart gun (Pneu dart, Knoxville, TN). We will monitor vital rates including temperature, pulse, and visual observation of respiration, pulse, and capillary refill of gums and will remain at the capture site to monitor animals until they are fully ambulatory following anesthesia.

Processing will consist of morphological measurements, marking animals with numbered identifiable ear-tags. We will collect tissue and blood samples to assess physical condition, test for disease, and analyze and catalogue DNA profiles. We will determine sex by examining visible genitalia and age from measurements of gum regression (Laundre et al. 2000). Lions will be assigned to age classes as kitten (0-12 months), juvenile (13-24 months), and adult (25+ months). All captured animals will be fitted with collars equipped with Global Positioning System (GPS) and VHF transmitters (VECTRONIC Aerospace, Carl-Scheele-Str. 12 D-12489, Berlin Germany), weighing <650 gm (< 5% of body weight). Collars will be fitted with cotton spacers designed to break-away from the animal after approximately one year (Hellgren et al. 1988). Collars are programmed to collect GPS coordinates at 4-hour intervals and location data will be sent from satellites via email.

Table 11. DNA results of scat samples collected in Missouri in 2014.

Sample ID	Type	Location	Date Collected	DNA Result	Sex	Individual	Recapture?
MDC-1	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-2	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-3	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-4	Scat	Peck Ranch Conservation Area	3/25/2014	bobcat			
MDC-5	Scat	Peck Ranch Conservation Area	3/25/2014	Cougar	Male	MO-MDC-5	no
MDC-6	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-7	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-8	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-9	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-10	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-11	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-854-1	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-854-2	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			

BLACK BEAR DISTRIBUTION AND STATUS

Summary
The MDC completed a new management plan for black bears in Missouri in 2008. The plan was drafted and approved by a multi-agency group of resource professionals from the Missouri Department of Conservation, U.S. Forest Service, National Park Service and Missouri Department of Natural Resources during summer of 2008 and was signed and approved by MDC administration during fall of 2008.

Black bear goal/vision statement:
To encourage black bear population expansion within their natural range in Missouri, and to manage black bears consistent with the available habitat and within the limits of human tolerance.

Black bear program objectives:

- Increase knowledge about current black bear population status in Missouri.
- Increase knowledge of black bear ecology in Missouri, how they move, disperse and travel on a landscape level and identify source and sink populations.
- Develop black bear conservation and management strategies based on information gathered through research, monitoring and surveys.
- Educate Missouri's public, the media and other resource professionals in Missouri and the Midwest about black bears and Missouri's black bear management program.

The entire black bear management plan can be viewed on SharePoint at:
http://mdcsharepoint/sites/resourcescience/Documents/Terrestrial%20Fauna/Furbearers/Black%20Bear%20Management%20Plan%20November%2025%202008.pdf.

Black bear research – population estimation

American black bears (*Ursus americanus*) are an important wildlife resource in Missouri, yet little information is known about their population status. Black bears were believed to be extirpated from Missouri by the early 1900s due to overharvest and deforestation; however, they have been naturally recolonizing and increasing in abundance in southern areas of the state since the 1960s. Increased abundance has resulted in more interest in black bears as well as nuisance complaints and safety concerns from the public. The Missouri Department of Conservation (MDC) is encouraging range expansion of black bears while managing the species consistent with available habitat and within limits of human tolerance. MDC's intent is to conduct research that will increase knowledge of black bear ecology critical for developing conservation and management strategies. The objectives of this project are to:

1. Develop synthesis of history, status and management of black bears in Missouri;
2. Quantify occurrence and magnitude of heterogeneity in capture probabilities, and
3. Estimate abundance and density of black bears in Missouri.

In a recently recovering population of black bears, such as in Missouri, establishing an accurate and robust baseline population estimate is critical for developing a reliable long-term conservation plan. The estimated population size derived from this overall study will influence decisions to implement a bear hunting season in the state. Understanding the sources of heterogeneity in Capture Mark Recapture studies is essential for producing sound population estimates to manage Missouri's black bear population.

Study Area

The study area was derived from the 70 percent fixed kernel isopleth applied to black bear sightings (1989-2010) and comprises 29,775 km^2 in southern Missouri (Figure 43). The area was divided into two regions to be surveyed in different years: the south-central region in 2011 (13,508 km^2) and the southeastern/east-central region in 2012 (16,267 km^2). Land ownership is private and public, including Mark Twain National Forest and Ozark National Scenic Riverways. Predominant land covers include cropland (30.9%), pastureland (24.3%) and forest land (27.8%); (National Resources Inventory 2000). Forest cover in southern Missouri is dominated by oak-hickory (*Quercus alba, Quercus velutina, Quercus coccinea, Quercus rubra, Carya spp.*) and oak-pine (*Pinus echinata*) upland type forests (Missouri Department of Conservation 2011). Southern regions are rugged and mountainous with elevations ranging from 70-540 m (United States Geological Survey 2009). The Ozark Mountains are characterized by exposed formations of sandstone, chert, dolomite, limestone and igneous rocks (Batek et al. 2001). Southern Missouri (Climate Division 4 and 5) temperatures average 23.8°C (June-July 1989-2010) and precipitation (June-July 1989-2010) averages 218 mm (National Climatic Data Center 2011).

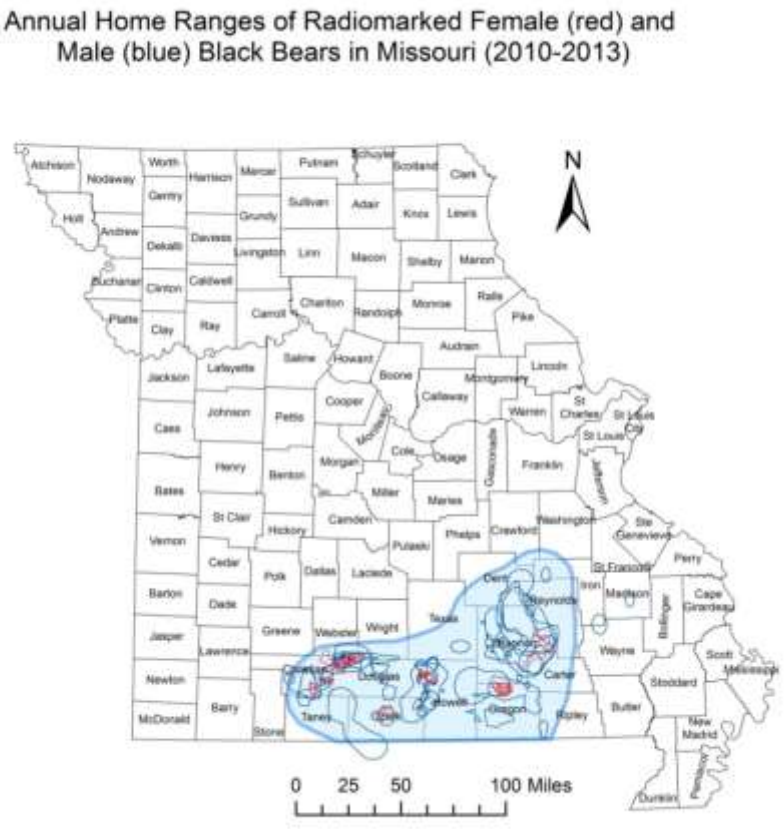

Figure 43. Missouri Black Bear annual range.

Physical capture and marking of black bears

Black bears are captured during September-October and May-August using Aldrich foot snares and cage traps. Captured bears are immobilized with 7 mg/kg tiletamine-zolazepam administered using a CO_2-powered rifle or syringe pole. Temperature, heart rate and respiration are monitored every 10 minutes during immobilization for at least 20 minutes post-induction. Morphometric measurements and body weight is recorded for each individual and an upper premolar tooth extracted for cementum aging analysis. Minor wounds caused by capture are treated with Betadine. Male and female bears are ear tagged and fitted with GPS collars (Northstar NSG-LD2, RASSL Globalstar, King George, Virginia, USA) programmed to collect locations every 10 minutes from 30 May to 28 July and one location per day thereafter. In order to maximize detail of bear movements during hair snare sampling sessions, locations were automatically downloaded every 10 minutes directly to an online database (Northstar Science and Technology, LLC) and illustrated using GIS.

Cumulative capture results

We captured 94 individual bears, 45 adults, 25 subadults, 21 yearlings, and 3 cubs (Figure 44). Of this total 55 were male and 38 were female. Ages were determined from cementum annulations on upper premolars (Figure 45). Captured bears were weighed, measured, and fitted with GPS equipped collars (Figure 45).

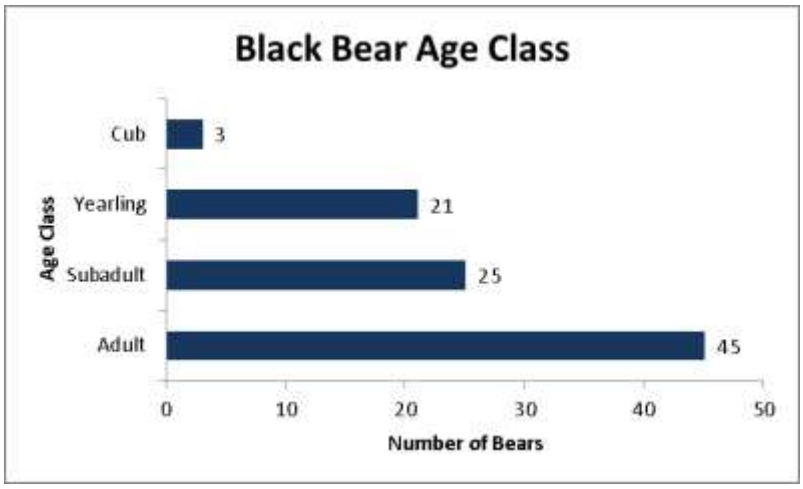

Figure 44. Black bear capture by age class

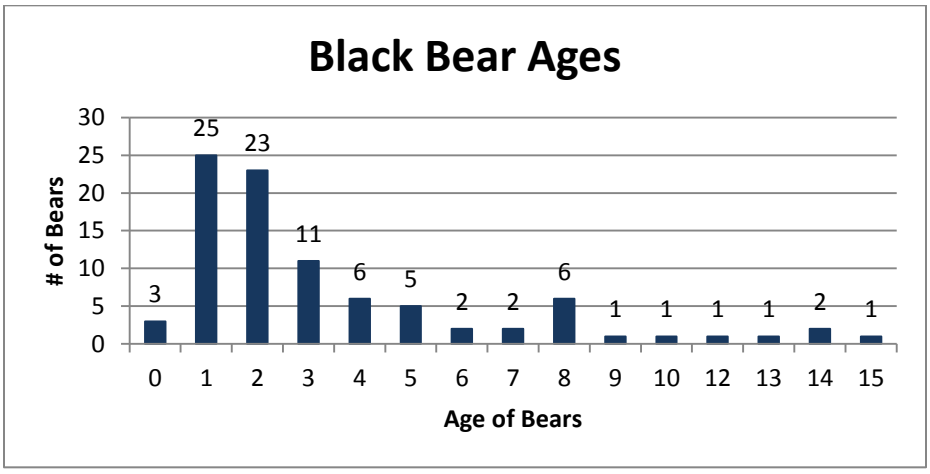

Figure 45. Ages of black bears captured as part of the Missouri black bear research project

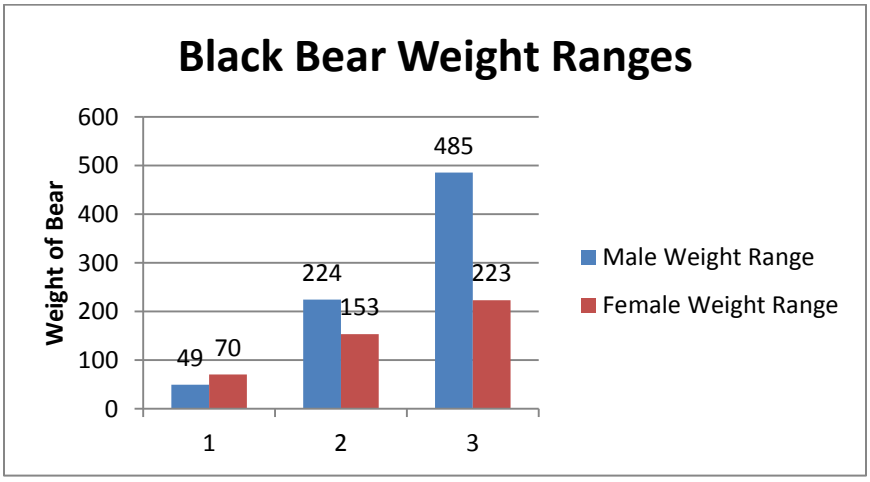

Figure 46. Weights of black bears captured as part of the Missouri black bear research project

Black bear range and reporting

Citizen reports of black bear sightings are important for delineating bear range expansion in the state. Reports of bears with cubs help to define the reproductive population of bears in Missouri. Bear sightings are reported to local Conservation staff and through an electronic reporting system.

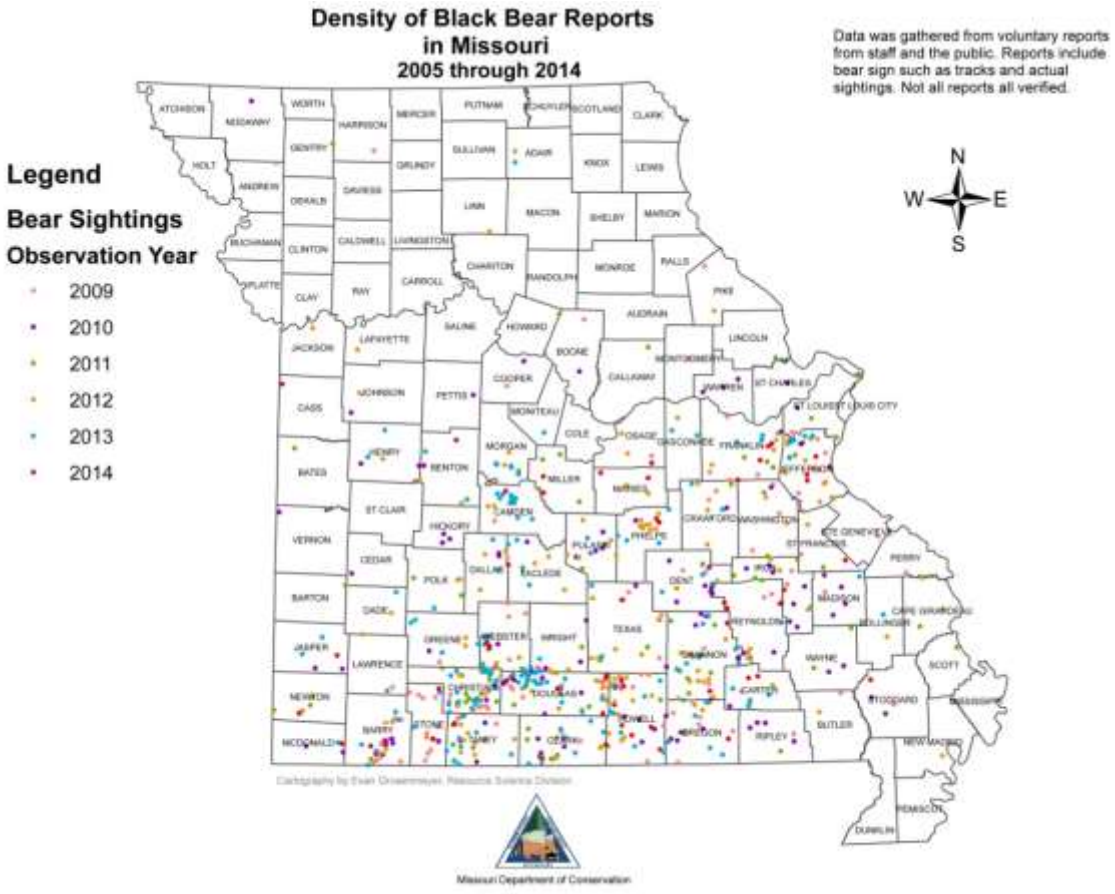

Figure 47. Bear sightings from 2009-2014.

Black bear research – survival and recruitment

Our initial population research suggested a 2012 statewide estimated population of just under 300 bears. In order to model bear numbers and estimate population trajectory we began a project to measure reproductive and survival rates of female bears in Missouri. Our goal is to capture and monitor at least 25 female bears annually for 5 years. This model in turn will be used to estimate the time at which the black bear population in Missouri will reach 500 animals and be large enough to implement a harvest season. In addition, we will look at habitat use and movement patterns to identify suitable black bear habitat and delineate travel corridors that link large tracts of suitable habitat. Currently we have 23 female bears, and 10 subadult males radio marked. A comprehensive project summary, data, and movements of marked individuals can be found at:
http://mdc4.mdc.mo.gov/applications/BearSleuth/Default.aspx

State Furbearer Records

We often receive calls from trappers, telling us about their latest, exceptionally large catch, wondering if it could be a new state record or asking what is the state record. In 2011, we began keeping information on record weight furbearers. Candidate furbearers must be brought to one of the statewide fur auctions or to the Central regional office in Columbia for weighing on a certified scale.

Current Record Furbearers

Species	Sex	Date Taken	County Taken	Weight (lbs.)	Hunter/Trapper
Badger	**M**	**11/28/11**	**Scotland**	**27**	**Joe Closser**
Beaver	**Ukn**	**1/5/2012**	**Livingston**	**72.2**	**Austin/ Jonathan Minnick**
Bobcat	**F**	**1/18/2014**	**Macon**	**36.0**	**Shane Viers**
Coyote	**M**	**1/20/12**	**Mercer**	**40.6**	**Jim Palmer**
Gray Fox	**M**	**1/14/11**	**St. Genevieve**	**9.8**	**Kenneth Naeger**
Muskrat	**M**	**1/29/2013**	**Boone**	**3.6**	**Chuck Regnireb**
Nutria	**M**	**1/18/11**	**Dunklin**	**10.4**	**Bart Hiller**
Opossum	**M**	**1/25/2012**	**Lafayette**	**13.4**	**Kevin Whitworth**
Red Fox	**M**	**12/20/10**	**Gasconade**	**11.6**	**Bill Placht**
River Otter	**M**	**Unknown**	**Osage**	**31.2**	**Jacob Rehagen**
Striped Skunk	**M**	**1/31/2014**	**Laclede/ Camden**	**6.14**	**Ashley Radenz**

Table 12. The current Furbearer Record holders.

TRAPPER OPINION SURVEY

We surveyed trappers to get their opinions on several regulatory issues and to measure trapper effort as part of our otter/bobcat harvest study. We attempted to survey both regular and occasional trappers by randomly selecting our pool of trappers from those that purchased permits in each of the last three years and from those that purchased permits only 1 of the last three years. The overall selection was made up of:

a. Those who purchased 3 out of 5 years – 924 (46.20%)
b. Those who purchased 4 out of 5 years – 503 (25.15%)
c. Those who purchased 5 out of 5 years – 573 (28.65%)

Overall 77% of trappers were very or somewhat satisfied with the current furbearer management program, respondents were split when polled about the current trapping season length but a clear majority favored lengthening the regular trapping season to 20 February. A majority of trappers reported using cable restraints and supported a mandatory training session prior to a person using them. Most respondents did not support mandatory trapper education. Survey questions and responses are summarized below (Figures 48-5

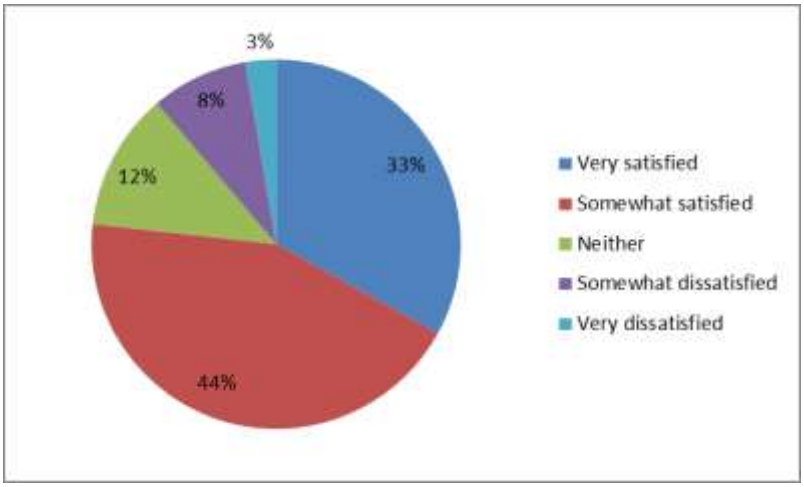

Figure 48. Overall, how satisfied or dissatisfied are you with the current furbearer management program?

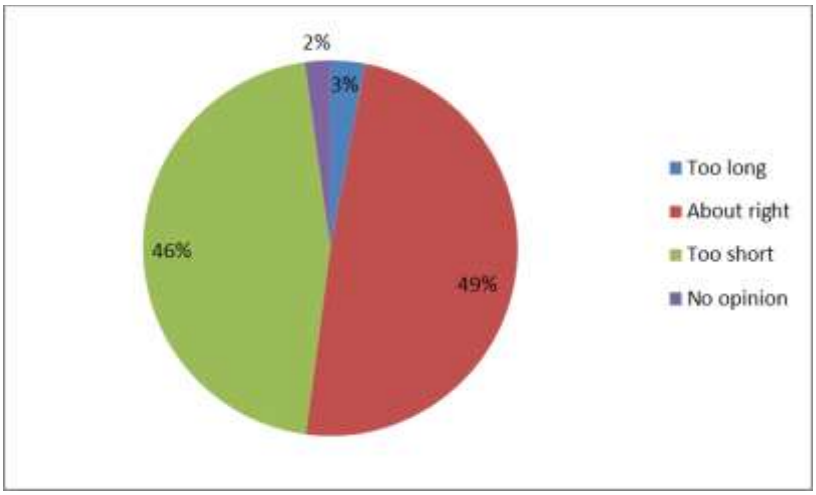

Figure 49. Do you think the current general furbearer trapping season (November 15 to January 31) is too long, too short, or about right?

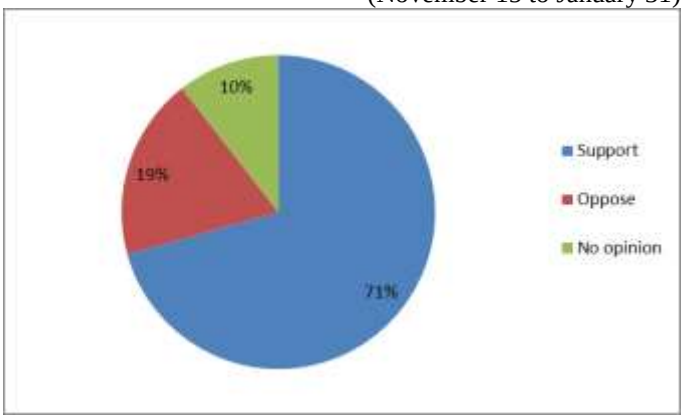

Figure 50. Would you support or oppose extending the general trapping season to February 20th?

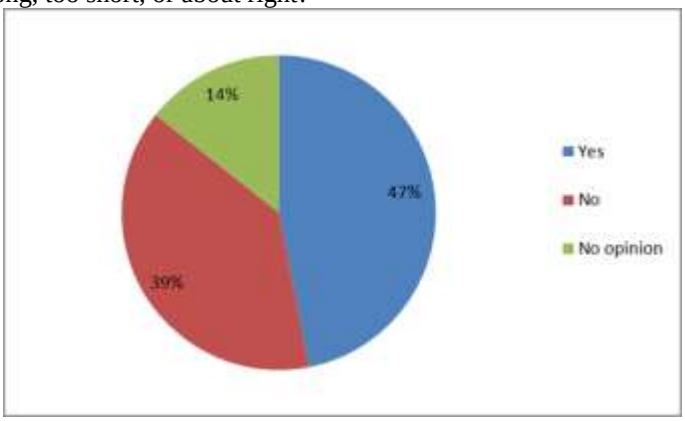

Figure 51. Do you believe cable restraint training should be mandatory (required)?

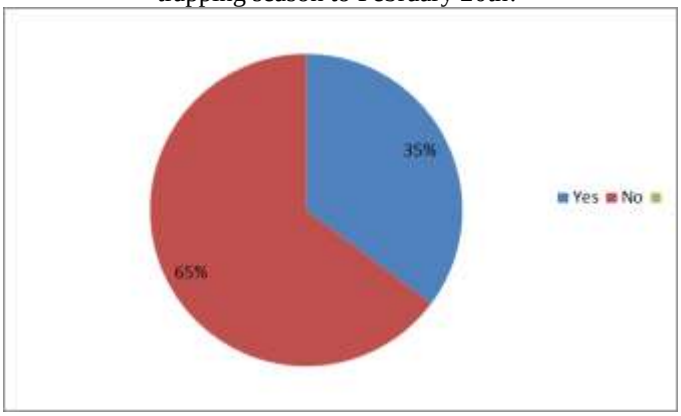

Figure 52. Do you use cable restraints?

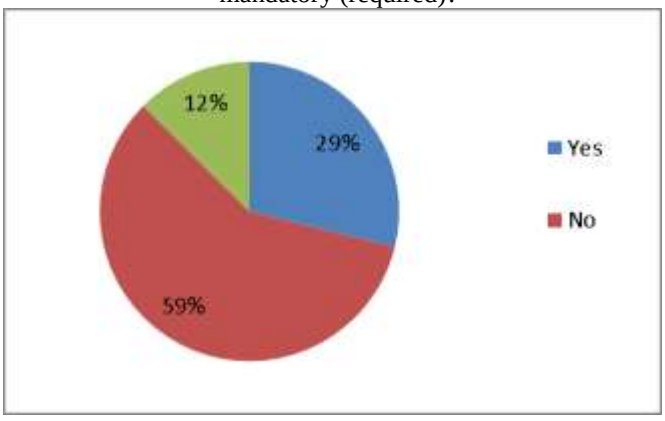

Figure 53. Do you believe trapper education should be mandatory (required)?

MULTI-STATE GRAY FOX GENETICS

Population genetics of gray fox (*Urocyon cinereoargenteus*) in the Midwest, USA

Background: The gray fox is widespread and relatively abundant across much of North America and into central and northern South America. Morphological differences across its range have been recognized by dividing the species into 16 subspecies, 4 of which occur in the eastern U.S. (Figure 54). It is legally harvested in most states. Despite the ecological and economic importance of gray fox, surprisingly little research has been done on this species, including genetic analyses. Identifying the locations of genetic boundaries, if they exist, in gray fox is relevant for the conservation and management of this species. In particular, a recent petition to list the prairie gray fox under the Endangered Species Act has stimulated the USFWS to initiate a status review to determine if listing is warranted (Department of the Interior 2012). However, it is uncertain whether the prairie gray fox is actually a genetically distinct segment of the contiguous gray fox range.

Figure 54. Map of gray fox subspecies ranges.

Issues:

- It is unclear whether the current subspecies delineations reflect the actual structure of gray fox populations
- Recent study across 15 states found little genetic differentiation between the two southeastern subspecies (*U. c. cinereoargenteus* and *U. c. floridanus*).
- No genetic data from gray fox in range of *U. c. ocythus*

Questions:

- Is the "prairie gray fox" (*U. c. ocythus*) genetically unique relative to surrounding populations?
- If so, what is its range? Does it match the current subspecies map?

Research Goals:

- Sample gray fox across the United States to cover a broad range of habitats and subspecific designations
- Sequence the same 411 bp segment of the mtDNA control region to compare results with the eastern samples analyzed in Bozarth *et al*. (2011)
- Develop nuclear genetic markers

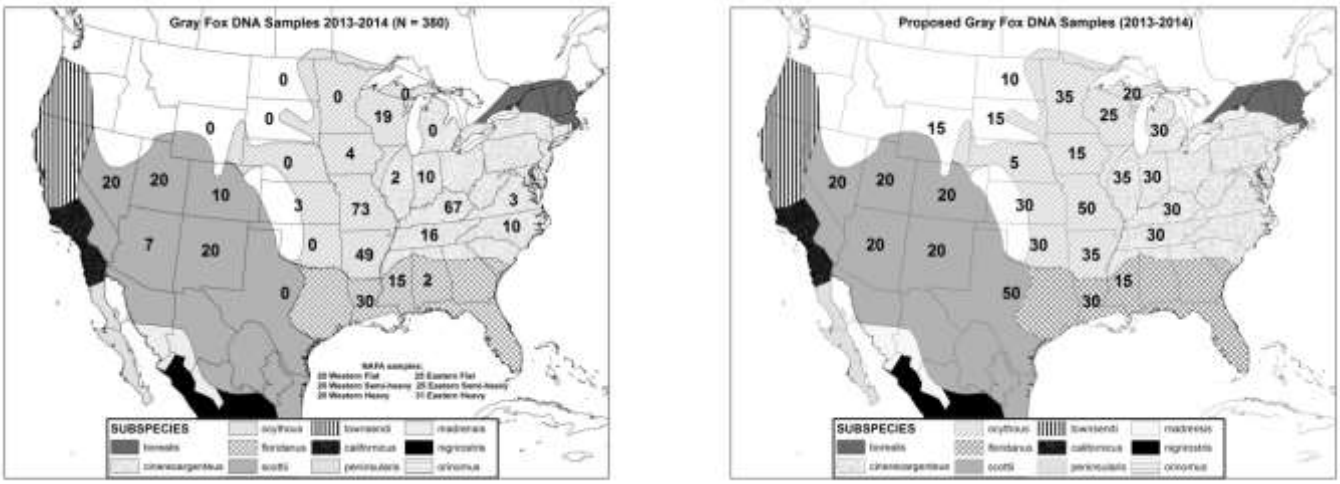

Figure 55. Collected and proposed grey fox samples to determine subspecies via mtDNA sequences.

Preliminary results:

- Found 17 distinct mtDNA sequences ("haplotypes") among the 49 individuals:
  - 10 of these haplotypes are newly discovered
  - 7 were found in eastern gray fox.
- Haplotype network shows little geographic structure:
  - Midwestern haplotypes are often the same as, or genetically close to, those found in the eastern U.S.
  - Some haplotypes are shared between multiple sites